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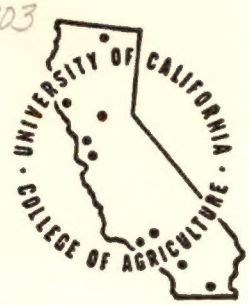

DIVISION OF AGRICULTURAL SCIENCES
UNIVERSITY OF CALIFORNIA

A Study of the Economy Of Napa County, California

IRVING HOCH and
NICKOLAS TRYPHONOPOULOS

JAN 6 1970

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A STUDY OF THE ECONOMY OF NAPA COUNTY, CALIFORNIA

by

Irving Hoch[1/] and Nickolas Tryphonopoulos[2/]

INTRODUCTION

This study investigates the structure and workings of the Napa County economy. Napa County is of considerable interest for a number of reasons. Wine production in the County is prestigious and renowned; Lake Berryessa, developed in recent years by the Bureau of Reclamation, is an important and growing recreation center; and Napa's location on the periphery of the Bay area implies some important problems which arise because of urbanization and the impact of urbanization on agriculture (and on vineyards in particular).

The work should be of interest to persons concerned with Napa County and to economists, planners, and regional scientists concerned with the general problem of the investigation of the economy of a small area.

The major focus of the study is the construction and application of input-output tables for the County. The base year for those tables is 1965; they are applied in a series of conditional forecasts, predicting the effect of a particular change, and then in a general forecast of economic levels as of 1980.

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1/ Formerly Associate Professor of Agricultural Economics and Associate Agricultural Economist in the Experiment Station and on the Giannini Foundation, University of California, Berkeley; presently with Resources for the Future, Inc., Washington, D. C.

2/ Formerly Postgraduate Research Agricultural Economist, Department of Agricultural Economics, University of California, Berkeley; presently Assistant Professor of Economics, York University, Toronto, Canada.

The development of input-output tables entails the collection, collation, and organization of a great deal of information on the economy covered by the tables. Such information is a useful by-product of the effort. The present study includes some of the more important by-product items that emerged in the table construction process.

There was heavy reliance in the study on primary data developed through sample survey questionnaries and personal interviews. Survey questionnaries were developed to cover consumer spending behavior, farm operations, commercial and industrial firm operations, and attitudes on the preservation of grape land, respectively. There were 500 questionnaires mailed to Napa County residents for the consumer spending survey; 300 to farms; 500 to commercial and industrial firms; and approximately 1,100 to residents, farmers, wineries, and community leaders for the grape land preservation survey. The response rates were 16, 20, 11, and 21 percent for the four samples, respectively. The commercial and industrial survey was supplemented by a number of interviews with Napa business officials, and there was a series of interviews with officials of 15 Napa County wineries. The wineries involved account for almost all Napa County wine sales.

The study is organized in the following manner:

The second section develops some of the major economic magnitudes for Napa County. Such data are of use both as descriptive measures of the County economy and as inputs helpful in developing the input-output tables for the County.

The third and fourth sections focus on major growth sectors in the economy. The future of these sectors involves important policy issues, with ramifications outside the County. The third section is a study of the Napa grape and wine sectors, while the fourth section covers remaining key growth sectors, including Lake Berryessa recreation, the housing market, and consumer spending as a

fraction of income--in particular, spending within versus outside the County as income increases. The focus again is the development of material to be used in the input-output apparatus, both in constructing the tables and in developing the data to be used with those tables in making forecasts. Beyond this application, the material should be of interest in its own right. Thus, the discussion of the grape and wine sector develops information on production, cost, and demand prospects and then considers vineyard preservation. The County has recently introduced Agricultural Preserve zoning, and there has been a great deal of interest in the permanent preservation of grape land. The policy issues and group interests involved are discussed here. The preservation discussion is then placed in the general context of housing market developments in the following section. That section also develops evidence showing that the creation of Lake Berryessa will have a growing impact on housing in the County as well as serving an increasing number of recreationists.

The fifth and sixth sections of the study are the culmination of the work, with the development of the input-output tables in the fifth section and their application in the sixth, and final, section. The first part of the fifth section is a short introduction to input-output models. Then, a step-by-step presentation discusses procedures used in constructing the Napa input-output tables. Because some of the procedural details can be tedious for readers not interested in the more technical aspects of input-output construction, such readers might skim a large part of this section, perhaps devoting some attention to preliminary stages of the construction presented in tabular form, and then move to the input-output tables--the outcome of the work. The last section is devoted to input-output applications, including a set of conditional forecasts (forecasts conditional on a specific event or development) and to a general forecast of the

County economy. In all cases, forecasts are made from the base year 1965 to a target year of 1980. The conditional forecasts are concerned with (1) the impact of manufacturing expansion, (2) the impact of out-of-county employment at the Mare Island Shipyard in Solano County, (3) the impact of the Lake Berryessa development in terms of tourist spending and induced housing, and (4) the impact under alternative policies on grape land preservation (involving prevention versus freely permitted urbanization in the northern part of Napa County). The general forecast for 1980 presents projected outputs for the sectors into which the County economy has been classified and compares these output levels with those that held in 1965, noting high growth versus low growth sectors.

Given the existence of the input-output tables, other applications become relatively easy and inexpensive. In particular, forecasts made in the present study can be updated, given more current information, in rather straightforward fashion. And additional problems can be considered within the input-output framework so that it can serve as a useful planning tool.

MAJOR ECONOMIC MAGNITUDES FOR NAPA COUNTY

This section develops some of the major economic magnitudes for Napa County. Such figures are of use both as descriptive measures of the structure and development of the County economy and as source statistics of help in constructing input-output tables for the County.

Geography

Napa County is located northeast of San Francisco Bay, about 45 miles from the Pacific Ocean. Its county seat, the City of Napa, is about the same distance (45 miles) from San Francisco. It has a total area of 793.75 square miles,

consisting of a land area of 758 square miles and an area of 35.75 square miles covered by water.[1/]

The County's length from north to south is about 45 miles, while its width from west to east varies from approximately 10 to 30 miles. Napa County shares boundaries on the southeast with Solano County, on the east with Yolo County, on the north with Lake County, and on the west with Sonoma County. It includes the northern reaches of San Pablo Bay on the south.

Napa County is considered part of the nine-county "Bay area" and the seven-county "Redwood Empire."[2/]

The County topography consists of a number of parallel mountain ridges with intervening valleys of relatively narrow widths. The mountains are part of the Coast Range, and their general direction is from northwest to southeast, following the coast line.

Figure 1 is a map of the County, indicating the hill and mountain areas versus the valley areas.

The largest by far of the County's valleys and the site of virtually all the populated communities in the County is Napa Valley, which is located between the Howell Range on the east and the mountain ridge which separates Napa from Sonoma County on the west. Napa Valley extends approximately 30 miles north of the city of Napa to Calistoga. The width of the Valley is about 5 miles on the south, but it narrows gradually between the mountain ridges and is about 1 mile in the vicinity of Calistoga. There are a number of smaller valleys in the County. Pope

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1/ California Economic Development Agency, California Statistical Abstract, 1964 (Sacramento, 1964), pp. 1, 22, and 42.

2/ Bay area counties are San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa, Solano, Napa, Sonoma, and Marin. Redwood Empire counties are Marin, Sonoma, Napa, Lake, Mendocino, Humboldt, and Del Norte.

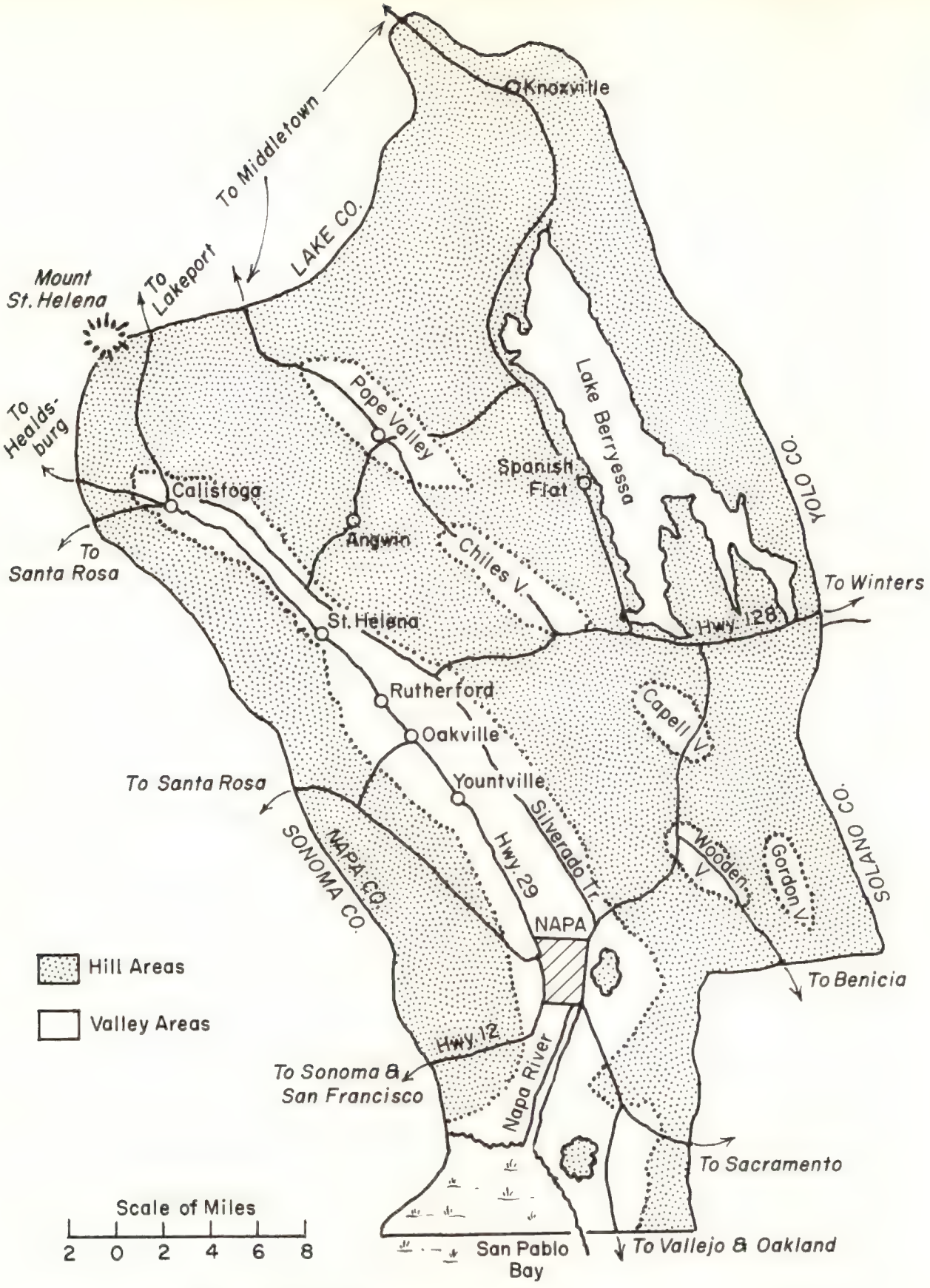

FIGURE 1. General Topographic Map of Napa County, California

Source: John N. Fiske, Farming in Napa County, Napa County Agricultural Extension Service (Napa, California, 1963), p. 2.

Valley, an oval-shaped valley about 9 miles long and 3 miles wide which drains into Lake Berryessa, is the largest among them. The other valleys include Chiles Valley, Capell Valley, Wooden Valley, and Gordon Valley.

The Berryessa Valley in the northeast part of the County was about 10 miles long and 1.5 to 2 miles wide. It was flooded by the Bureau of Reclamation, in conjunction with the construction of Monticello Dam, and now forms Lake Berryessa, which has become a popular boating and fishing recreation area.[1/]

The climate of Napa County is typically Mediterranean with warm, dry summers and mild but moist winters. It is warmer and less foggy than the San Francisco Bay area but is much cooler than the Sacramento and San Joaquin Valleys. The climate, of course, is an important natural resource in the production of Napa's premium grapes and wine.

Table 1 lists data on County area and land use. Much of the County is in forest and woodland, reflecting a rugged terrain. Though 300,000 acres were in farms in 1959, only about 40,000 acres were in harvested cropland. Table 2 reinforces the image of generally rugged terrain. The table exhibits the distribution of Napa County soil classes. More than half the County land is suitable only for limited grazing or forestry, at best. On the other hand, about 20 percent is classified as "fairly good," or better, land.

Population and Income

Napa County population as of 1965 was approximately 76,000 (62.5 percent above the level of 1950). The corresponding state increase was 76.9 percent so that Napa growth, though marked, was somewhat below that for the state as

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1/ National Park Service, Public Use Plan, Monticello Reservoir (Lake Berryessa, California, 1959), contains detailed information on Lake Berryessa.

TABLE 1

Area Distribution and Land Use, Napa County

Land use	Area distribution
	1,000 acres
County area distribution	
Total County area	508[a/]
Land	485
Lake Berryessa	19
Other inland bodies of water	3
Land use (1958)	
Federal land[b/]	62
Urban	24
Cropland[c/]	46
Pasture and range	45
Private forest and woodland	304
Other[d/]	4
Farm-nonfarm distribution (1959)	
Land in farms	296
Land not in farms	189

a/ Subcategories do not add to exact total due to rounding.

b/ Includes 52,000 acres of forest land.

c/ Harvested cropland was 38,000 acres in 1959.

d/ Includes farmsteads, idle land, and wildlife areas.

Sources:

James M. Campbell, Economic Survey--Napa County, Master Plan Project, Part I (Napa, California, 1960), p. 2.

National Park Service, Public Use Plan, Monticello Reservoir (Lake Berryessa, California, 1959), p. 4.

L. T. Wallace and John W. Mamer, Napa County: Selected Economic Data, University of California, Agricultural Extension Service (Berkeley, 1966), pp. 28 and 29.

California Economic Development Agency, California Statistical Abstract, 1964 (Sacramento, 1964), pp. 22 and 42.

TABLE 2

Soil Quality Classification (Soil Conservation Service Classes), Napa County

Soil class and description	Napa County acreage	Percent of total
I. Very good. Level, little or no erosion.	14,430	2.85
II. Good. Use involves easily applied practices.	28,650	5.67
III. Moderately good. Needs intensive treatments.	23,450	4.64
IV. Fairly good. Best suited to pasture. Requires erosion protection.	26,340	5.21
V. Grazing or forestry--slight or no limitations.	0	0
VI. Grazing or forestry--minor limitations, careful management.	56,710	11.22
VII. Grazing or forestry--major limitations.	192,040	37.98
VIII. Suitable only for wildlife and recreation.	141,800	28.05
Unclassified	22,180	4.38
Total[a/]	505,600	100.00

a/ Includes land inundated by Lake Berryessa.

Source: James M. Campbell, Economic Survey--Napa County, Master Plan Project, Part I (Napa, California, 1960), pp. 8 and 9, citing U. S. Soil Conservation Service, State of California, Department of Natural Resources.

a whole. Table 3 lists comparative population statistics for the years 1940, 1950, 1960, and 1965. Data appear for the state, the County as a whole, major cities in the County, and major groups by (urban-rural) residence.

Both urban and rural nonfarm populations show substantial increases in Napa County with the urban rate of increase somewhat higher. Rural farm population shows a substantial decline with the 1960 level approximately half that of 1940.

The city of Napa is the major city in the County with a population about 39 percent of the County total in 1965. (This compares with 33 percent in 1960 and 27 percent in 1940, reflecting a much higher rate of growth for the city of Napa than for the County as a whole.)

The smaller cities of St. Helena and Calistoga each contain about 3-4 percent of the County total population.

Table 4 lists percentage increases in population for Bay area counties between 1960 and 1964. Napa's percentage increase was less than that of most counties (and well below Santa Clara and Marin). Hence, problems arising from rapid population increase should be somewhat less pronounced for Napa than for its neighbor counties at present.

Napa's institutional population comprises roughly 12 percent of the total relative to a state figure of around 1 percent.[1/] The large institutional population reflects the location in the County of Napa State Hospital, the State of California Veterans Home at Yountville, and the St. Helena Sanitarium.

Table 5 lists estimates of average personal income for the "family and unrelated individual" income unit for 1949 and 1959. The income unit is equivalent

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1/ U. S. Bureau of the Census, U. S. Census of Population: 1960. Vol. I, Characteristics of the Population, Part 6, California, 1963, p. 6-197.

TABLE 3

Comparative Population Statistics, Napa County and California
1940, 1950, 1960, and 1965

Area	1940	1950	1960	1965	1950/1940	1960/1950	1965/1960
	1	2	3	4	5	6	7
Napa County	28,503	46,603	65,890	75,760[a]	1.635	1.414	1.150
Calistoga	1,124	1,418	1,514	[b]	1.262	1.068	
City of Napa[c]	7,740	13,579	22,170	29,800	1.754	1.633	1.344
St. Helena	1,758	2,297	2,722	3,191	1.307	1.185	1.172
Urban	7,740	15,127	24,892		1.954	1.646	
Rural nonfarm	13,805	25,674	37,398		1.860	1.457	
Rural farm	6,958	5,802	3,600		.834	.620	
California	6,907,400	10,586,200	15,717,200	18,726,000	1.533	1.485	1.191
Napa County/California	.00412	.00440	.00419	.00405	1.066	.952	.966

(Continued on next page.)

TABLE 3--continued.

a/ Authors' estimate developed from regression equation. An estimate of 75,700 appears in California Department of Finance.

b/ Blanks indicate no data available.

c/ Annexations occurred between 1950 and 1960.

Sources:

Cols. 1, 2, and 3: For Napa County, U. S. Bureau of the Census, U. S. Census of Population: 1960. Vol. I, Characteristics of the Population, Part A, Number of Inhabitants, 1961, Table 6, p. 6-23.

For Calistoga, city of Napa, and St. Helena, ibid., Table 8, pp. 6-28 to 6-30.

For urban, rural nonfarm, and rural farm, L. T. Wallace and John W. Mamer, Napa County: Selected Economic Data, University of California, Agricultural Extension Service (Berkeley, 1966), p. 2, citing U. S. Bureau of the Census, U. S. Census of Population: 1960. Vol. I. . . .

For California, California Department of Finance, Revenue and Management Agency, California Population, 1966 (Sacramento, 1966).

Col. 4: For Napa County, ibid., p. 21.

For Calistoga, ibid., p. 35. This lists 1,875 as of December, 1963. This is a growth of 24 percent relative to 1960.

For city of Napa and St. Helena, ibid. (estimated as of June 1, 1965, and August 1, 1965, respectively).

For California, ibid., p. 22 (estimate as of July 1, 1965).

TABLE 4

Population Growth for Bay Area Counties and California
1960-1964

Area	Percent increase in population
County	
Napa	12.05
San Francisco	1.92
San Mateo	17.70
Santa Clara	29.57
Alameda	9.59
Contra Costa	19.36
Solano	14.73
Sonoma	15.32
Marin	22.31
California	14.95

Source: California Economic Development Agency, California Statistical Abstract, 1964 (Sacramento, 1964), p. 51.

TABLE 5

Estimated Personal Income for the "Family and Unrelated Individual" Income Unit, Napa County, 1949 and 1959[a]

Locale	Average personal income for the family and unrelated individual	
	1949[b]	1959[b]
	1957-1959 dollars	
Napa County	4,902	6,835
City of Napa	5,611	6,833
St. Helena	[c]	5,875
Rural nonfarm[d]	4,441	6,848
Rural farm	4,875	7,593

a/ The income unit is equivalent to the household, consisting of the family or the unrelated individual (a person not living with a family consuming unit). For Napa County, there were 13,710 income units in 1949 and 20,546 income units in 1959.

b/ The 1949 and 1959 figures have been adjusted for price level changes using the consumer price index. Both sets are in 1957-1959 dollars. The 1949 price index, in fractional terms, was .83. The 1959 price index was 1.015. Figures in the table can be converted to current dollars by multiplying by the appropriate index.

c/ No data available.

d/ 1949 figure includes St. Helena--1959 figure does not.

Sources:

U. S. Bureau of the Census, U. S. Census of Population: 1950. Vol. II. Characteristics of the Population, Part 5, California, 1952, pp. 5-71, 5-129, 5-176, and 5-178.

Idem, U. S. Census of Population: 1960. Vol. I. Characteristics of the Population, Part 6, California, 1963, pp. 6-250, 6-357, 6-405, 6-411, 6-435, and 6-452.

For the adjustment procedures applied to the data in developing final estimates, see infra, p. 16.

to the household or consuming unit, consisting of the family or the unrelated individual not living with his family. For Napa County, these were 13,710 income units in 1949 and 20,546 in 1959.[1/] Table 5 presents average income data for the County, for the cities of Napa and St. Helena, and for the rural nonfarm and farm populations.

The estimates in the table were developed from Census of Population data, adjusted for under-reporting and to conform to the personal income definition of the U. S. Office of Business Economics (OBE).[2/] The OBE income series makes up a part of the national income and product accounts widely used in economic measurement.

It was estimated that 1949 income figures from the Census were 0.8 the corresponding OBE figures, while those for 1959 were 0.9 the corresponding OBE figures. There were three reasons for this, of which two were definitional and one involved a measurement problem. The definitional problems were that (1) nonmoney income (consisting of imputed rental value of owned housing and value of homegrown food) did not appear in the Census figures but did appear in OBE estimates and (2) OBE estimates included the value of services of banks and other financial institutions rendered without assessment of specific charges and the income of persons who died or emigrated prior to the time of enumeration.[3/]

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1/ Idem, U. S. Census of Population: 1950. Vol. II, Characteristics of the Population, Part 5, California, 1952, p. 5-129, and U. S. Census of Population: 1960. Vol. I . . ., p. 6-357.

2/ Idem, U. S. Census of Population: 1950. Vol. II . . ., pp. 5-71, 5-129, 5-176, and 5-178, and U. S. Census of Population: 1960. Vol. I . . ., pp. 6-250, 6-357, 6-405, 6-411, 6-435, and 6-452. For areas smaller than the County, income data on unrelated persons were not given in the 1960 Census and were estimated from 1950 relationships for those areas, modified on the basis of 1950-1960 changes occurring for California and Napa County.

3/ Ibid., p. XXXVIII.

The measurement problem arose because there was a substantial amount of underreporting of income, particularly of dividend and interest income in the 1950 Census of Population.[1/]

Hence, averages derived from the Census were adjusted, using the 0.8 factor for 1949 and the 0.9 factor for 1959. Finally, income figures for Table 5 are presented in terms of constant dollars on the basis of deflation by the consumer price index.

Table 6 presents estimates of population, per capita income, and aggregate income for Napa County for each year in the period 1947 through 1965.

Population figures were estimated from a linear regression equation of the form

$$Y = 3{,}662{,}600 + 1902.47320\ X$$

where X is year and Y is population. (Only five observations were involved, so the equation can best be viewed as a means of interpolating for missing years close in time to those observed.) Initial estimates of Napa per capita

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1/ Herman P. Miller, "An Appraisal of the 1950 Census Income Data," Journal of the American Statistical Association, Vol. 48, No. 261 (March, 1963), pp. 28-43. The 0.80 figure in 1949 can be viewed as consisting of the product of these three fractions: 0.949, reflecting omission of imputed income; 0.956, reflecting uncharged services and income of decedents and emigres; and 0.885, reflecting underreporting of income.

The product of these fractions is 0.80, equaling the ratio of Census to OBE estimates. The increase of the ratio to 0.90 in 1959 probably reflects less imputed income from homegrown food and increased accuracy of measurement of income from dividends and interest. These figures are based on data in Irving Hoch, Forecasting Economic Activity: Income and Taxes (Chicago, Illinois: Chicago Area Transportation Study, 1958), pp. 7, 30, and 31.

TABLE 6

Estimated Population and Income, Napa County
1947-1965

Year	Population	Per capita income	Deflated per capita income	Napa per capita income relative to state per capita income	Aggregate income
	1	2	3	4	5
		current dollars	1957-1959 dollars		current million dollars
1947	41,520	1,090	1,400	.642	45.26
1948	43,420	1,187	1,416	.693	51.54
1949	45,320	1,231	1,483	.714	55.78
1950	47,220	1,371	1,636	.745	64.74
1951	49,130	1,550	1,713	.756	76.15
1952	51,030	1,645	1,778	.767	83.94
1953	52,930	1,712	1,837	.777	90.62
1954	54,830	1,710	1,826	.782	93.76
1955	56,740	1,840	1,972	.792	104.40
1956	58,640	1,977	2,088	.807	115.93
1957	60,540	2,010	2,052	.800	121.69
1958	62,440	2,050	2,036	.812	128.00
1959	64,350	2,213	2,186	.827	142.40
1960	66,250	2,231	2,164	.821	147.80
1961	68,150	2,352	2,257	.849	160.29
1962	70,050	2,449	2,324	.851	171.55
1963	71,960	2,547	2,387	.860	183.28
1964	73,860	2,661	2,462	.865	196.54
1965	75,760	2,792	2,540	.874	211.52

(Continued on next page.)

TABLE 6--continued.

Sources:

Col. 1: Obtained from regression equations using five observations on population; Table 3, supra, p.11, for 1940, 1950, and 1960. Data for 1961 and 1962 from California Economic Development Agency, California Statistical Abstract, 1964 (Sacramento, 1964), p. 51.

Col. 2: Initial data covering 1947, 1950, 1953, and 1955-1961 were obtained from California State Chamber of Commerce, Research Department, Economic Survey Series, "Total Personal Income of California Residents, By Counties, Selected Years, 1947-1961," No. 22 (Sacramento, 1963) and "Personal Income of California Residents, By Major Components, By County--1957," No. 24 (Sacramento, 1962). These data were compared to California data from U. S. Office of Business Economics, Survey of Current Business, Vol. 46, No. 4 (April, 1966), pp. 10 and 11, and Vol. 45, No. 7 (July, 1965), p. 10. Missing years were interpolated on the basis of the comparison. Then, the series was adjusted on the basis of a comparison to the data of Table 5, supra, p. 14.

Col. 3: Obtained by dividing current income by the consumer price index in fractional form.

Col. 4: Estimated.

Col. 5: Per capita income times population.

income were available for selected years in the period.[1/] These data were compared to corresponding income figures for the state of California.[2/] A trend in the ratio of Napa to California per capita income was developed and used to interpolate missing years in the Napa series. Then, Napa aggregate income for 1949 and 1959 were formed as the product of population and per capita income for the respective years. These figures were compared to aggregate income data based on Table 5. The comparison indicated an understatement had occurred here, so scale factors were applied to the entire series to yield the final estimates appearing in Table 6.[3/]

The aggregate income estimates in Table 6 were obtained by multiplying the population estimate by the final per capita income estimate.

Economic Activity

The number of employed residents of Napa County increased by 47 percent in the decade 1950-1960, somewhat above the population growth of 41 percent. Table 7 presents the distribution of Napa County employment by industry for 1950 and 1960. The primary industries--agriculture, forestry, and mining--exhibit an absolute decline in employment, though the latter two industries are quite minor in terms of total employment. Wholesale trade also declined

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1/ California State Chamber of Commerce, Research Department, Economic Survey Series, "Total Personal Income of California Residents, By Counties, Selected Years, 1947-1961," No. 22 (Sacramento, 1963) and "Personal Income of California Residents, By Major Components, By County--1957," No. 24 (Sacramento, 1962). The years covered were 1947, 1950, 1953, and 1955-1961.

2/ U. S. Office of Business Economics, Survey of Current Business, Vol. 46, No. 4 (April, 1966), pp. 10 and 11, and Vol. 45, No. 7 (July, 1965), p. 10.

3/ The 1949 adjustment needed was a multiplication of the initial estimate by 1.13; the 1959 adjustment factor was 1.12. Then, 1.13 was used as a scale factor for all years in the period 1947-1953 and 1.12 for all years in the period 1954-1965.

TABLE 7

Industry Group of Employed Persons Residing in Napa County
1950 and 1960

Industry	Number of persons		
	1950	1960	1960/1950
Total	14,626	21,495	1.47
Agriculture	1,833	1,316	0.72
Forestry and mining	144	125	0.87
Construction	1,129	1,361	1.21
Manufactures	2,949	5,057	1.71
(Primary metal)[a/]	(43)	(542)	(12.60)
(Transportation equipment)	(1,246)	(2,204)	(1.77)
(Food and kindred)	(390)	(686)	(1.76)
(Apparel)	(326)	(449)	(1.38)
(Printing and publishing)	(161)	(351)	(2.18)
Transportation, communication, and utilities	642	1,078	1.68
Wholesale trade	337	280	0.83
Retail trade	2,203	3,172	1.44
Finance, insurance, and real estate	331	642	1.94
Services	4,190	6,466	1.54
Public administration	626	1,185	1.89
Not reported	242	813	3.36

a/ Parentheses indicate manufactures subcategory.

Sources:

U. S. Bureau of the Census, U. S. Census of Population: 1960. Vol. I, Characteristics of the Population, Part 6, California, 1963, p. 6-429.

Idem, U. S. Census of Population: 1950. Vol. II, Characteristics of the Population, Part 5, California, 1952, p. 5-170.

in employment. Substantial employment increases occurred in manufacturing (72 percent); finance, insurance, and real estate (94 percent); and public administration (89 percent). The large number of persons employed in the transportation equipment industry primarily reflects employment at the Mare Island Shipyards, located approximately 20 miles south of the city of Napa in Solano County.

It should be noted that Table 7 lists data on persons residing in Napa County--their place of employment may be elsewhere. The Mare Island case is an important specific example.

Tables 8 and 9 conclude this section by presenting some detailed information on specific industries. Table 8 presents data on agricultural production by broad categories over the period 1955-1965.

Napa agricultural production as a whole increased by about 60 percent between 1955 and 1965. Since the agricultural price level has been quite stable in this period, it seems likely the increase occurred primarily by way of increased quantity produced.[1/] Animal production and fruit and nut crops both increased by about 60 percent in the period, while field and truck crops increased by over 100 percent. Livestock and livestock products made up 65 percent of total production in 1955 and 64 percent in 1965, fruit and nuts

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1/ U. S. Department of Agriculture, Statistical Reporting Service, Crop Reporting Board, Agricultural Prices: 1967 Annual Summary, June, 1968, p. 6. In 1955 the index was 96; in 1964 it was 98; and in 1965 it was 103, on a base of 1957-1959 = 100. The Department of Labor wholesale price index for farm products was 94.3 in 1955 and 98.4 in 1965. These data are applicable to Napa County insofar as its pattern of production roughly parallels that of the country. Inspection of detailed categories of County input supports this interpretation. For price index, see:

U. S. Economic Research Service, The Farm Index, Vol. V, No. 11 (November, 1966), p. 2.

U. S. Congress, Joint Economic Committee, 1964 Supplement to Economic Indicators, 88th Cong., 2d Sess., 1964, p. 95.

TABLE 8

Agricultural Production by Broad Categories
Napa County, 1955-1965

Year	All agricultural production	Animal production	Fruit and nut crops	Field and truck crops
	1,000 dollars			
1955	13,838	9,011	4,151	677
1956	13,992	8,149	5,103	740
1957	12,799	8,509	3,683	607
1958	15,255	10,232	4,404	619
1959	18,266	12,234	5,450	582
1960	16,925	10,502	5,078	1,344
1961	18,216	12,432	4,336	1,448
1962	21,567	14,016	6,233	1,318
1963	19,390	13,205	4,830	1,356
1964	19,285	13,341	4,374	1,570
1965	22,350	14,220	6,669	1,462
1965/1955	1.615	1.578	1.607	2.160

Source: Napa County Agricultural Commissioner, Agricultural Crop Report (Napa, California, annual issues).

TABLE 9

Employment, Total Wages, and Average Wage for Industries
Napa County, 1964

Industry	Employees	Total wages	Average wage per employee	Napa average wage relative to state average wage
		1,000 dollars	dollars	
Manufactures	2,681	17,104	6,380	.876
Wholesale and retail trade	2,907	13,049	4,489	.851
Services	1,484	5,004	3,372	.649
Contract construction	822	5,850	7,116	.882
Finance, insurance, and real estate	477	2,115	4,434	.759
Transportation, communication, and utilities	977	6,451	6,603	.916

Source: California Department of Employment, California Employment and Payrolls, Report 127, No. 27d, October-December, 1964 (Sacramento, 1965).

comprised 30 percent of output in both years, and field and truck crops moved from 5 percent to 6 percent of the total between 1955 and 1965.

Grapes are the most important commodity in the fruit and nut crop category, ranging in value from about one-half to two-thirds of total production in the category. Other crops are prunes, pears, and walnuts. Beef, feeders, milk, and eggs--in that order--are the major livestock commodities in terms of value of production.[1/]

Table 9 presents 1964 data on a number of employees, total wages, and average wage per employee for selected industries located within Napa County. (This is in contrast to the data of Table 7 which was based on residence rather than workplace.)

Table 9 also lists the ratio of Napa average wage by industry to that of the state of California. In all cases, Napa wages are below those of the state. Inspection of data for earlier years indicates little or no change in the differential between 1958 and 1964. It seems plausible that a good deal of the difference reflects higher living costs in large metropolitan areas relative to small areas, such as Napa County. (The large metropolitan areas will account for a major share of the state figures.)

The lack of change for specific industries contrasts with the increase in Napa income relative to state income, shown in Table 6. Perhaps this reflects redistribution of workers between industries (for example, the large increase of manufacturing employment shown in Table 7) and increasing income in agriculture (Table 5).

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1/ Napa County Agricultural Commissioner, Agricultural Crop Report (Napa, California, 1955 and subsequent annual issues).

In any event, it seems reasonable to predict the upward trend in relative income will continue, since it is likely that Napa County will become more urbanized and more highly integrated into the Bay area economy over time.

THE NAPA GRAPE AND WINE SECTORS

Napa grape and wine production is prestigious and renowned; so much is this the case that there is often overstatement of the facts. Thus, the New York Times, in an editorial concerned with negative aspects of urban expansion, writes: "Even the sundrenched Napa Valley *where most of California's wines are now grown* [authors' italics] is seriously threatened."[1/] It would be more accurate to restate Napa's share as "an important part of premium table wine production for the state as a whole."

With respect to the role of grapes and wine within the Napa economy, the following is pertinent: Napa grape production comprised about 15 percent of total value of agricultural output in 1964 and a bit over 20 percent in 1965.[2/] Total Napa manufacturing employment in 1965 was about 2,850;[3/] estimated winery employment (from survey data presented below) was about 400 in 1965 or approximately 15 percent of manufacturing employment. Hence, grape and wine production comprise an important (but not overwhelming) part of agricultural and manufacturing production, respectively.

Aside from their direct economic contributions, a number of spillovers and externalities are associated with grape and wine production. Many tourists visit the Napa wineries annually, presumably deriving benefits therefrom.

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1/ "The Green Legacy," New York Times, Editorial, January 9, 1965, p. 24.

2/ Table 8, infra, p. 22; Table 14, supra, p. 33.

3/ From data in California Department of Employment, California Employment and Payrolls, Report 127, No. 28d, October-December, 1965 (Sacramento, 1966).

Again, there are persons who claim "benefits" flow from the allocation of Napa land to vineyards rather than subdivisions, so that a shift from the former to the latter is seen as a bad thing. The concern with vineyard preservation might be labeled a variant of "conservationism."

A good deal of attention, therefore, is devoted to the grape and wine sectors in this study. In summary, this is because (1) grape and wine production is important in the Napa economy, (2) there are associated externalities which generate interest and concern outside the County as well as within it, and (3) changes here can be expected to be of great importance in future economic activity and land use in the County.

In this section, attention will first be directed to the economic aspects of grape and wine production, and then the matter of vineyard preservation will be examined. Primary data sources in the first phase include survey questionnaires to farms and wineries and personal interviews with winery officials. A primary data source in the second phase was a survey questionnaire on attitudes toward vineyard preservation, directed to Napa County residents. Future prospects for grape and wine production are of concern in both phases.

Grape and Wine Production

Grape Production

Data on 1964 wine grape acreage developed by Kenneth R. Farrell is presented in Table 10. The table lists acreages for the three main wine grape regions of the state: Central Valley, southern California, and Central Coast. Then, for the Central Coast (in which Napa County is located) a county-by-county breakdown is given. Table 11 employs the data of Table 10 to exhibit Napa acreage as a fraction of a given region in which Napa is located. Thus,

TABLE 10

Wine Grape Acreage by Region and County, California, 1964

Region and county	Total	Bearing	Nonbearing	Nonbearing as percent of total
	acres			
Central Valley	70,917	63,463	7,454	10.5
Southern California	21,577	21,280	297	1.3
Central Coast	39,703	35,317	4,386	11.0
Total California	132,197	120,060	12,137	9.2
	Central Coast distribution			
North Bay				
Humboldt	a/			
Lake	103	103		0.0
Marin	1	1		0.0
Mendocino	5,185	4,519	666	12.8
Napa	11,323	10,171	1,152	10.2
Solano	620	530	90	14.5
Sonoma	11,400	10,754	646	5.7
Total	28,632	26,078	2,554	8.9
South Bay				
Alameda	2,043	2,001	42	2.1
Contra Costa	1,443	1,443		0.0
Monterey	1,104	69	1,035	93.8
San Benito	2,724	2,026	698	25.6
San Luis Obispo	494	494		0.0
San Mateo	13	13		0.0
Santa Clara	3,157	3,100	57	1.8
Santa Cruz	93	93		0.0
Total	11,071	9,239	1,832	16.5

a/ Blanks indicate zero.

Source: Kenneth R. Farrell, "The California Grape Industries: Economic Situation and Outlook," Statement presented at a public hearing in Fresno, California, March 14, 1966 (Berkeley: California Agricultural Extension Service, 1966), p. 22, citing California Crop and Livestock Reporting Service, California Fruit and Nut Acreage: Bearing and Nonbearing as of 1964 (Sacramento, 1965), p. 11.

TABLE 11

Napa County Wine Grape Acreage as Fraction of Regional Acreage, 1964

Region	Napa County as fraction of region		
	Bearing and nonbearing acreage	Bearing acreage	Nonbearing acreage
North Bay	.395	.390	.451
Central Coast	.285	.288	.263
California	.086	.085	.095

Source: Calculated from data in Table 10, supra, p. 27.

Napa's total acreage (bearing and nonbearing) is roughly 40 percent of the North Bay total, 30 percent of the Central Coast total, and 10 percent of the state total.

Nonbearing acreage figures in both Tables 10 and 11 are instructive in indicating where expansion in grape production is occurring. In absolute terms, Napa County shows the greatest nonbearing acreage of all the Bay counties. Evidence to be presented below indicates this reflects expansion of Napa production. A good deal of expansion is also occurring in Monterey, San Benito, Mendocino, and Sonoma counties.

Table 12 continues the comparison of Napa and California wine grape production, comparing yield per acre in tons and value per ton as well as bearing acreage. Napa County yield per acre was about 0.4 of the state average in 1964 and about 0.6 of the state average in 1965. Napa grape value per ton was about twice that of the state in 1964 and 2.5 times that of the state in 1965. These differences reflect relative Napa concentration in high-quality table wine, often with low yields in terms of tons per acre but with high values per ton. It is also apparent that production and price are subject to a good deal of year-to-year variability.

The total value of Napa wine grape production was about $3 million in 1964 and $5 million in 1965, comprising roughly 6.5 percent of the total value of state production in 1964 and 13 percent in 1965. Hence, Napa's share of total California wine production (in value) averages about 10 percent. Its share of premium table wine production is substantially larger, of course, and may be roughly estimated at about 30 percent, based on its share of Central

TABLE 12

Wine Grape Acreage, Yield, and Value, Napa County and California
1964 and 1965

Area and year	Bearing acres	Production	Yield per acre	Total value	Value per ton
		tons		1,000 dollars	dollars
California					
1964	120,060	608,000	5.06	43,898	72.20
1965	123,013	750,000	6.10	36,225	48.30
Napa County					
1964	10,286[a/]	19,760	1.92	2,905	147.00
1965	10,561	40,063	3.79	4,808	120.00
Napa County/California					
1964	.086	.033	.379	.066	2.036
1965	.086	.053	.621	.133	2.484

a/ Includes 81 acres of raisin grapes and 34 acres of table grapes so that wine grapes total, in exact terms, equals 10,171 as listed in Table 10. Since nonwine grape amounts are quite minor, no adjustment of the listed figures was attempted.

Sources:

California Crop and Livestock Reporting Service, California Fruit and Nut Statistics, 1964-65 (Sacramento, 1966), p. 3.

Napa County Agricultural Commissioner, Agricultural Crop Report, 1965 (Napa, California), Fruit and Nut Crops: Acreage Production Value (table).

Coast production in Table 11. The Central Coast can be identified as the "fine wine" district of California.[1/]

Additional details on quality of grapes produced appear in Table 13, which lists bearing acreage of wine grapes as of 1961 and 1964 by variety for Napa County and the state. Cabernet Sauvignon, Pinot Noir, Johannisberger Reisling, Pinot Blanc, and Sauvignon Blanc are usually included in lists of premium varieties.[2/] Napa's share of the state's bearing acreage for these varieties ranged from 25 to 60 percent in 1964 (Table 13).[3/]

Detailed time series data on Napa grape production appear in Table 14, spanning the period 1955-1965. The value of grapes, relative to all fruits and nuts, shows an upward trend for the period, moving from somewhat under 50 percent to somewhat over 70 percent. Bearing acreage shows a small decline and then a somewhat larger increase, while tons produced and tons per acre exhibit great variability.[4/] Over the 11-year period, average yield is 3.145

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1/ Frank Schoonmaker, Encyclopedia of Wine (New York: Hastings House, 1964), p. 57. Schoonmaker, writing in the Spring, 1962, issue of Almaden's News from the Vineyards is quoted in "The Q. & A. Promotional Path," Wines & Vines, Vol. 43, No. 7 (July, 1962), p. 19:

> "What can properly be called 'great wine country' is a limited area of plentiful sunshine and cool winds off the cool Pacific, north and south of San Francisco Bay. About a half dozen counties share this climate--from south to north, San Benita, Santa Clara, Alameda (Livermore), Sonoma, Napa, Mendocino; Santa Cruz and Contra Costa could perhaps be included, but they have few vineyards."

2/ Frederick S. Wildman, "Fine Wines of California," Gourmet (June, 1966), pp. 52-56, gives his highest rating to these five wines; see, also, "The Q. & A. Promotional Path," Wines & Vines, p. 18.

3/ The Johannisberger Reisling was included within a general category labeled "Franken Reisling."

4/ This reflects the impact of weather variability, disease, pests, etc. Thus, John Fiske noted a reduction of 1965 Napa tonnage by approximately 50 percent, owing to a heavy spring frost; see San Francisco Examiner, January 12, 1965, p. 55.

TABLE 13

Bearing Acreage of Wine Grapes by Variety, Napa County and California, 1961 and 1964

Variety	1961 Bearing acreage Napa County	1961 Bearing acreage California	1961 Napa County/California	1964 Bearing acreage Napa County	1964 Bearing acreage California	1964 Napa County/California
Alicante Bouschet	228	9,472	.024	223	9,112	.024
Burger	232	2,820	.082	243	2,413	.101
Burgundy[a/]	752	1,076	.699	756	1,077	.702
Cabernet Sauvignon[b/]	387	606	.639	504	834	.604
Carignane	819	23,361	.035	811	24,198	.034
Colombar	38	481	.079	521	1,056	.493
Franken Riesling[c/]	327	1,193	.274	382	1,527	.250
French Columbard	298	1,465	.203	450	2,183	.206
Gamay	554	717	.773	688	868	.793
Grand Noir[d/]	270	444	.608	267	440	.607
Green Hungarian	191	392	.487	191	378	.505
Grenache	17	10,808	.002	17	13,701	.001
Malvoisie[e/]	40	1,097	.036	40	1,120	.036
Mataro	25	2,886	.009	25	2,649	.009
Mission		8,289			8,581	
Palomino[f/]	332	8,977	.037	330	8,165	.040
Petite Sirah[g/]	1,748	4,440	.394	1,791	4,506	.397
Pinot Blanc[h/]	278	811	.343	417	944	.442
Pinot Noir[i/]	166	556	.299	198	716	.277
Salvador		2,142			2,250	
Sauvignon Blanc[j/]	890	1,962	.454	447	1,213	.369
Sémillon	221	1,243	.178	226	1,284	.176
Valdepeñas	49	826	.059	49	1,106	.044
Zinfandel	949	23,516	.040	955	22,004	.043
Other while varieties	153	1,300	.118	201	1,083	.186
Other dark varieties	354	3,955	.090	439	5,119	.086
Total	9,318	114,835	.081	10,171	118,527	.086

a/ Includes Early Burgundy, Crabb's Black Burgundy, Mondeuse, Portuguese Blue, and Refosco.

b/ Includes Cabernet, Cabernet Blanc, and Cabernet Vert.

c/ Includes all Rieslings and Sylvaner.

d/ Includes Calmette.

e/ Includes Black Malvoisie and Cinsaut.

f/ Includes Golden Chasselas, Chasselas de Fontainbleau, Gutedel, and Sweet Water.

g/ Includes Duriff.

h/ Includes Chenin Blanc, White Pinot, Pinot de la Loire, White Zinfandel, and Pinot Vray.

i/ Includes Black Pinot.

j/ Includes Sauvignon, Sauvignon Blanc, Sauvignon Vert, and Sauvignon Petite.

Source: California Crop and Livestock Reporting Service, California Grape Acreage by Varieties and Principal Counties as of 1964 (Sacramento, 1965), 5p.

TABLE 14

Data on Grape Production and Values, Napa County, 1955-1965

Year	Value of grapes relative to all fruits and nuts	Bearing acreage in grapes	Value of grape production	Tons produced	Tons per acre	Average value per ton[a/]	Value per acre[b/]
			1,000 dollars			dollars	
1955	.468	10,400	1,994.6	32,743	3.15	60.9	191.8
1956	.488	10,456	2,490.2	41,504	3.97	60.0	238.2
1957	.429	10,389	1,581.1	30,405	2.92	52.0	151.8
1958	.567	9,775	2,497.4	39,959	4.10	62.5	256.3
1959	.390	9,623	2,123.1	31,454	3.26	67.5	220.1
1960	.436	9,623	2,213.4	23,800	2.47	93.0	229.7
1961	.544	9,623	2,358.3	16,845	1.75	140.0	245.0
1962	.633	9,800	3,591.6	39,516	4.03	100.0	403.0
1963	.637	10,025	3,076.3	32,382	3.23	95.0	306.9
1964	.664	10,286	2,904.7	19,760	1.92	147.0	282.2
1965	.721	10,561	4,807.6	40,063	3.79	120.0	454.8

(Continued on next page.)

TABLE 14--continued.

a/ Obtained by dividing value of grape production by tons produced.

b/ Obtained by multiplying tons per acre times average value per ton.

Source: Napa County Agricultural Commissioner, Agricultural Crop Report (Napa, California, annual issues).

tons per acre. Average value per ton shows a general upward trend, as, of course, does value per acre, with an approximate doubling in value for both measures between 1955 and 1965. Available evidence indicates a long-term shift in Napa County into grapes from other fruit. This probably reflects changing prices and returns in favor of grapes. This impression was reinforced by personal interviews with Napa winery officials and by the following statement by James V. Lider made in early 1966: "Recent lowering of returns to prune and walnut growers has encouraged some to pull the trees and the owners are planting grapes."[1/] That this is probably a long-term trend is suggested by a comparison of grape and prune acreage, production, and value for the years 1922 and 1962. In the 40-year period, prune acreage declined substantially, production was approximately stable, and value of production increased by about 33 percent relative to the 1922 value. Grape acreage increased by about one-third, production by one-fourth, and the value of production more than doubled.[2/]

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1/ James V. Lider, Napa County Farm Advisor, "Farm Advisors Report on 1965 Grape Crop in California's Major Grape Counties," Wines & Vines, Vol. 47, No. 2 (February, 1966), p. 21.

2/ The exact figures in Napa County Agricultural Commissioner, Agricultural Crop Report, 1964 (Napa, California), are:

Crop and year	Acreage	Production	Value
		tons	1,000 dollars
Grapes			
1922	7,300	30,000	1,750
1962	9,800	39,516	3,952
Prunes			
1922	11,822	8,000	1,250
1962	6,282	7,510	1,652

Because grape production constitutes an important land use, it is of some interest to consider estimates of grape land value per acre. Interviews with winery officials yielded a number of estimates, with a general range of about $2,000-$5,000 per acre for land on the Napa Valley floor, around $700-$1,000 per acre for land on the Valley sides, and approximately $500 per acre for land in the "side passes" off the Valley. Valley floor land value figures were generally concentrated in the $2,000-$3,000 ranges.[1/]

Additional evidence can be obtained from the Bank of America Crop Manual which indicates that the average rental for Napa grape land is one-third crop share, assuming an average of 3 tons per acre.[2/] (The tonnage average squares well with the average tonnage figure of 3.145 derived from Table 14.)

One-third crop share on the average, then, is about 1 ton; in 1965 the average value of a ton of grapes was $120 in Napa County (Table 14). If this rental figure is capitalized at an interest rate of 6 percent, the capitalized land value is $2,000 per acre, which squares well with previous estimates. Thus, it seems reasonable to estimate the overall average value of grape land at $2,000-$2,500 per acre. Given roughly 10,000 acres in grapes, an estimate of overall value of Napa grape land would be in the range of $20 million-$25 million as of 1965. (Of course, the estimate refers to value in agricultural use; some grape land might have higher opportunity costs in terms of nonagricultural use.)

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1/ Interviews with officials of Beaulieu, Beringer, Heitz, Martini, Mayacamas, Mondavi, Schramsberg, and Souverain wineries, 1966 and 1967. Some of the estimates were based on land purchases in recent years. Thus, a sale of 500 acres of Napa vineyard land in 1962 occurred at a price of $2,700 per acre. Wines & Vines, Vol. 43, No. 2 (February, 1962), p. 7, reporting the sale of the Schoch vineyard, 5 miles south of St. Helena, to the Charles Krug (Mondavi) Winery.

2/ Bank of America, "Estimation of Crop Production Costs: Santa Rosa--Grapes, Nonirrigated, Napa-Sonoma Counties," Crop Manual (Santa Rosa, California: Santa Rosa Appraisal District Office, 1962), p. 485.

Wine Production

Table 15 lists published data on winery crush of California grapes for Napa and the state in selected years during the period 1950-1965. The Napa crush is about 5 percent of the total and squares well with Napa tonnage relative to the state (Table 12). To be precise, the fraction crushed is a bit above the fraction produced (0.057 versus 0.053, respectively, for 1965), which could be taken to indicate imports of grapes exceed exports; however, grape crush for Napa is somewhat below tonnage produced (39,200 versus 40,000), indicating net exports. The latter interpretation is supported by evidence below. The apparent contradiction is explained on the basis of substantial shipments of fresh grapes from California to wineries outside the state. As a consequence, 690,000 tons of wine grapes were crushed in the state as opposed to a total 1965 production of 750,000 tons.[1/]

In the remainder of this discussion of Napa wine production, primary reliance will be placed on a field study involving interviews with Napa winery officials and questionnaires filled out by those officials.

The list of wineries used in contacting the winery officials was obtained through the cooperation of the Wine Institute. A total of 15 wineries was involved in the field study; their production can be taken as essentially equal to total Napa wine production.[2/]

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1/ Based on Tables 12 and 15. Essentially, the same figures appear in Kenneth R. Farrell, "The California Grape Industries: Economic Situation and Outlook," Statement presented at a public hearing at Fresno, California, March 14, 1966 (Berkeley: California Agricultural Extension Service, 1966), 37p. The difference between production and crush consists of fresh shipments. These fresh shipments went out of the state. (Based on discussion with Dr. Farrell, January, 1967.)

2/ Only a few very small wineries with very limited production were omitted. It might be noted that the Census of Manufactures listed 15 active wineries in Napa in 1963. U. S. Bureau of the Census, Census of Manufactures, 1963. Location of Manufacturing Plants by County, Industry, and Employment Size, Part 9. Pacific Division, Special Report MC63(S)-4.9, 1966, p. 29.

TABLE 15

Winery Crush of California Grapes (Wine Varieties), Napa County and California, 1950, 1955, 1960, 1964, and 1965

Year	Napa County	California	Napa County as percent of California
	tons crushed		
1950	22,603	433,965	5.21
1955	37,657	524,068	7.19
1960	21,101	439,871	4.80
1964	21,164	547,906	3.86
1965	39,247	692,443	5.67

Sources:

Wine Advisory Board, Wine Institute Bulletin, No. 517, Fifteenth Annual Statistical Survey, Part I (San Francisco, March 9, 1951), p. 11.

Ibid., Nos. 806, 1090, 1318, and 1377 (San Francisco, 1956, 1961, 1965, and 1966, respectively).

Wineries contacted and cooperating in the study included the following:

1. Beaulieu Vineyard
2. Beringer Bros., Inc.
3. Heitz Wine Cellars
4. Hans Kornell Cellars
5. Louis M. Martini
6. Mayacamas Vineyards
7. C. Mondavi & Sons (Charles Krug)
8. Mont La Salle Vineyards (Christain Brothers)
9. Montebello Wine Company
10. Napa Valley Cooperative Winery
11. St. Helena Cooperative Winery
12. Souverain Cellars
13. Stony Hill Vineyards
14. Sunny St. Helena Winery
15. United Vintners, Inc. (Inglenook Vineyard Co.)

To avoid disclosure of confidential information, the 15 wineries have been grouped into three categories. These are (1) large wineries (6 firms), (2) small wineries (6 firms), and (3) crusher-cooperatives (3 firms). All of the small wineries had estimated 1965 sales below $500,000; all of the large wineries had estimated sales above $1 million. The crusher-cooperatives serve in an intermediate capacity for some Napa grape production; they crush grapes and ship the crushed grape juice to other wineries, both within and outside the County.

Table 16 lists estimated 1965 sales of wine and corresponding grape tonnage for the three classes of wineries defined above. Table 17 lists estimates of grape tonnage used by the Napa wineries by the source of the tonnage. Figure 2 summarizes the data of Table 17 in graphic terms, using rounded levels of the estimates in Table 16.

The material in Table 17 and Figure 2 attempts to show shipments of grapes and juice from Napa grape producers and to Napa wineries. The pattern involved is fairly complicated. Of the roughly 40,000 tons of grapes produced in Napa in 1965, it is estimated that approximately 11,000 tons were exported out of the County (sent to crushing stations outside the County), 10,500 tons were sent to Napa crusher-cooperatives, and 20,500 tons were sent to Napa wineries. The crusher-cooperatives in turn exported 8,500 tons out of the County, and 2,000 tons were shipped to Napa wineries. These 2,000 tons are not included

TABLE 16

Estimated Sales of Wine and Tons of Grapes Used
Napa County Wineries, 1965

Napa County wineries	Sales	Tons of grapes	Sales per ton	Fraction of sales
	1,000 dollars		dollars	
Large (6)	12,073	27,470	439	.834
Crushers (3)	1,481	10,465	142	.102
Small (6)	920	1,042	883	.064
Total	14,474	36,977[a/]		

a/ Reduced by 2,000 tons to avoid double counting; 2,000-ton equivalent was delivered from a crusher to one of the large Napa County wineries.

Source: Interviews with Napa County winery officials.

TABLE 17

Source of Estimated Grape Tonnage Used, Napa County Wineries, 1965

Napa County wineries	Own-grown grapes			Purchased grapes			Total grapes		
	Total	Produced in Napa County	Produced outside Napa County	Total	Produced in Napa County	Produced outside Napa County	Total	Produced in Napa County	Produced outside Napa County
	tons								
Large (6)	9,210	8,205	1,005	18,260	11,140	7,120	27,470	19,345	8,125
Crushers (3)	0	0	0	10,465	10,465	0	10,465	10,465	0
Small (6)	62	62	0	980	770	210	1,042	832	210
Total	9,272	8,267	1,005	27,705[a/]	20,375[a/]	7,330	36,977[a/]	28,642[a/]	8,335

a/ Reduced by 2,000 tons to avoid double counting; 2,000-ton equivalent was delivered from a crusher to one of the large Napa County wineries.

Source: Questionnaires and interviews with Napa County winery officials.

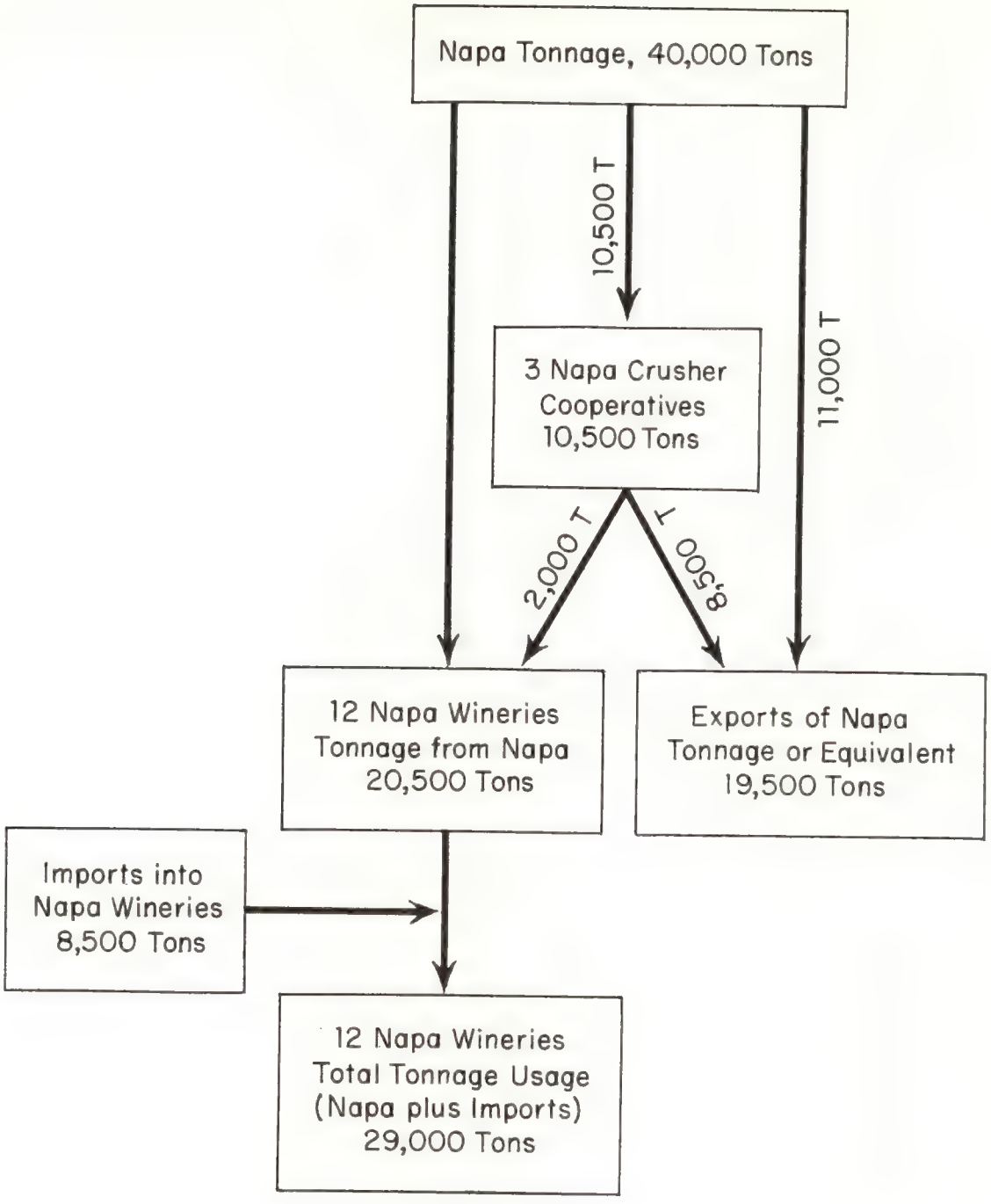
Napa Tonnage, 40,000 Tons
10,500 T
11,000 T
3 Napa Crusher Cooperatives 10,500 Tons
2,000 T
8,500 T
12 Napa Wineries Tonnage from Napa 20,500 Tons
Exports of Napa Tonnage or Equivalent 19,500 Tons
Imports into Napa Wineries 8,500 Tons
12 Napa Wineries Total Tonnage Usage (Napa plus Imports) 29,000 Tons

FIGURE 2. Estimated Flows of Grape Tonnage for Napa County Vineyards and Wineries [a/]

[a/] Wineries include three crusher cooperatives and twelve wineries (six large and six small firms) for a total of fifteen firms.

Sources: Questionnaires and interviews with officials and Napa County Agricultural Commissioner, Agricultural Crop Report, 1965 (Napa, California)

in the Napa winery total to avoid double counting. In addition, roughly 8,500 tons of grapes or grape equivalent were imported into Napa County by the Napa wineries. Some of the imports were in the form of grapes and some in the form of juice or unbottled wine.

Table 17 indicates that the 12 Napa wineries of this study (6 large and 6 small) produce about a third of their own grape tonnage or equivalent. They import about a quarter of their tonnage from other counties; some of these imports are from the wineries' own vineyards in other counties. Of Napa grape tonnage produced, almost half is exported in the form of grapes or juice. Hence, Napa is a net exporter of grape tonnage.

Tables 16 and 17 and Figure 2 tonnage information may be compared to Table 15, which lists Wine Advisory Board estimated crush. Tonnage usage and crush are fairly close and would be approximately the same if there were double counting here of the 2,000 tons shipped from a Napa crusher to a Napa winery. However, some of the Napa utilization is in the form of imports of juice or wine. Total Napa crush based on Figure 2 might be estimated at 36,000 tons (based on 10,500 tons crushed by Napa crushers, 20,500 tons of Napa grapes crushed by Napa wineries, and a rough estimate of 5,000 non-Napa grapes crushed by Napa wineries). This contrasts with the 39,000-ton figure of the Wine Advisory Board (Table 15). Aside from the difficulties inherent in estimation in general, possible explanations may include the double counting item noted above and the possibility that some of the 11,000-ton direct export of Figure 2 consisted of juice rather than fresh grapes. In any event, the discrepancy seems relatively minor.

Table 18 puts shipment data in value terms, assuming an average value of Napa grapes of $120 per ton (Table 14). The value of grape purchases by Napa wineries is estimated as 0.30 the value of their sales. Table 19 lists the

TABLE 18

Value of Grape Crop and Shipments, Napa County, 1965

Category		Value
		1,000 dollars
I.	Value of Napa grape crop	4,800
II.	Shipments into Napa wineries from Napa vineyards	3,500
III.	Shipments into Napa wineries from outside vineyards (imports)	850
IV.	Shipments from Napa vineyards to outside wineries	1,320
V.	Net exports	470
VI.	Total shipments into Napa wineries	4,350
VII.	Total shipments into Napa wineries as a fraction of sales	0.30

Sources:

I: Napa County Agricultural Commissioner, Agricultural Crop Report, 1965 (Napa, California).

II and IV: Approximated from tonnage given in Table 17 times $120 (average per ton); ibid.

III: Approximated from tonnage given in Table 17 times $100 (assumed average per ton for outside grapes).

V: IV minus III.

VI: II plus III.

TABLE 19

Distribution of Wine Grape Acreage by Category of Owner, Napa County

Category	Distribution	
	acres	percent
Owned by wineries	2,549	24.1
Other ownership	8,012	75.9
Total	10,561	100.0

Sources:

Interviews with Napa County winery officials.

Napa County Agricultural Commissioner, Agricultural Crop Report, 1965 (Napa, California).

distribution of Napa County wine grape acreage by category of owner. It turns out that wineries own about 25 percent of the grape acreage, with the remaining 75 percent owned by others--primarily farm operators. Table 20 exhibits the distribution of wine grape acreage owned by Napa wineries by location (inside versus outside the County) and by bearing status. It turns out that planted, but not yet bearing, acreage is 30 percent of bearing acreage, indicating substantial expansion in grape production in the near future. A significant part of this expansion (roughly 40 percent) is occurring outside Napa County. This contrasts with a bearing acreage outside the County of about 10 percent. Acreage not yet planted to grapes, but capable of bearing, amounts to 16 percent of presently bearing acreage, so that longer run expansion equal to this amount can occur as a minimum; additional expansion can, of course, occur by way of additional land purchases and by substitution of grapes for other commodities. Examples of such actions were noted above. (To reiterate, the above data refer to acreages of wineries only. One might expect other producers' behavior to be similar, however.)

Table 21 lists employment estimates for Napa County wineries in terms of total employment, wages, and average wage per employee.

Table 22 develops estimates of the distribution of winery costs as a fraction of total sales and the locational distribution of suppliers furnishing the inputs under various cost headings. (It should be noted that the grapes and labor estimates are fairly firm; some of the remaining estimates, however, had to be developed on the basis of limited information and are thus subject to some uncertainty.)

Tables 23 and 24 present summary information on visitors to the Napa wineries and sales to the visitors. In 1965 estimated visits to Napa wineries totaled about 450,000. Since many winery tourists visited more than one winery

TABLE 20

Distribution of Wine Grape Acreage of Wineries
by Location and Use, Napa County

Location	Acreage[a/]			
	Bearing	Planted, not yet bearing	Not yet planted	Total
Napa County	2,549	496	120	3,165
Outside Napa County	310	346	338	994
Total	2,859	842	458	4,159
Napa County/total	.892	.589	.262	.761

a/ Acreage figures do not include land in roads or structures or old wine grape land not classified as replantable.

Source: Interviews with Napa County winery officials.

TABLE 21

Winery Employment Estimates, Napa County, 1965

Category	Level
Sales	$14,474,000
Total wages paid by wineries (to winery and full-time vineyard workers)	$2,681,000
Winery employment	
Vineyard, full time	25
Wineries	403
Total employment	428
Average wage per employee	$6,265
Sales/wages	.185

Source: Questionnaires and interviews with Napa County winery officials.

TABLE 22

Estimated Distribution of Costs as a Fraction of Total Sales and Locational and Industry Source of Cost Items
Napa County Wineries, 1965

Cost item	Fraction of total sales	Locational source of cost items			Industry source of cost item
		Napa County	Bay area	Other	
		Fraction of total expenditure on given cost item			
Grapes	.300	0.80	0.08	0.12	Crop agriculture
Labor	.185	1.00	0	0	Households--labor payments
Depreciation, interest, and profit	.150	1.00	0	0	Households--capital payments
Utilities	.050	1.00	0	0	Utilities
Rent	.015	1.00	0	0	Rentals
Supplies	.085	0.15	0.40	0.45	Manufacturing and retail
Advertising	.035	0.20	0.40	0.40	Miscellaneous business services
Repairs	.045	0.20	0.40	0.40	Miscellaneous repair services
Insurance	.008	0.70	0.20	0.10	Finance, insurance, and real estate

(Continued on next page.)

TABLE 22--continued.

Cost item	Fraction of total sales	Locational source of cost items			Industry source of cost item
		Napa County	Bay area	Other	
		Fraction of total expenditure on given cost item			
Transportation	.010	0.50	0.35	0.15	Transportation
Legal and accounting services	.007	0.70	0.30	0	Professional services
Federal government	.090	0	0	1.00	Federal government
State and local government	.020	0.80	0	0.20	State and local government
Total	1.000	0.70[a/]	0.10[a/]	0.20[a/]	

a/ Obtained on basis of entries in body of table.

Source: Survey questionnaire replies.

TABLE 23

Estimated Visits and Sales to Visitors
Napa County Wineries, 1965

Measure	Amount
Number of visits to Napa wineries	449,800
Dollar sales to visitors	$781,300
Sales per visitor	$1.74
Total winery sales excluding crusher sales	$12,993,000
Sales to visitors relative to total sales	.06

Source: Interviews with Napa County winery officials.

TABLE 24

Growth in Number of Visitors for One of the Major Wineries, Napa County, 1960-1964

Year	Number of visitors relative to 1960
1960	1.000
1961	1.011
1962	1.136
1963	1.167
1964	1.196

Source: Visitor book; major Napa County winery.

on a specific touring day, the number of visitors involved must be substantially less. If visits per visitor were about 2.5, then 180,000 visitors toured Napa wineries in 1965. Estimated sales per visitor were about $1.75, with total sales to visitors approximately $800,000, amounting to about 6 percent of total winery sales.

Growth in number of visitors is apparently rapid, based on the experience of one of the major Napa wineries for the period 1960-1964, as exhibited in Table 24. There was a 20 percent growth in visits during the four-year period, thus averaging 5 percent per year.

It seems clear that tourism and associated retail sales by the wineries are mutually beneficial to the wineries and to the winery tourists. A tourist total of 180,000 is more than twice the Napa County population of 76,000; and growth in tourism seems manifest. As a rough estimate, approximately 35-40 persons are employed in the retail operations of the wineries. Some expansion of visitor capacity is being carried out. (Thus, in 1965 Beaulieu Vineyard added a 1,125 square foot visitors pavilion to accommodate a greater number of visitors.[1/])

Aside from the direct benefits of associated retail sales, Napa winery officials feel that having visitors is good public relations and is a successful way of promoting future wine consumption by the visitors. On the consumer side, the level and growth of tourism indicate a good deal of satisfaction is obtained by tourists to the wineries.

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1/ Wines & Vines, Vol. 46, No. 11 (November, 1965), p. 9, and interview with Beaulieu winery officials.

Growth Prospects for Napa Grape and Wine Production

The general tone of predictions for Napa wine and grape production was generally optimistic as of 1965. Strong demand and attendant "acceptable" price and income levels were forecast by grape and wine producers and by outside observers.

Such forecasts can be related to underlying consumer preferences as expressed in income elasticities of demand. Thus, Kenneth R. Farrell sees, as a reasonable expectation, a 2.5 percent per year growth in total demand for table wine as compared to a 1.5 percent per year growth in total demand for dessert wine. This assumes a population increase of 1.5 percent per year and a growth of 2.5 percent per year in per capita disposable income.[1/]

Farrell's figures indicate an income elasticity (per capita) of 0 for dessert wine and of 0.4 for table wine.[2/] It seems likely that the income elasticity for premium California table wine would be even higher--one might guess at a figure of at least 1.0.

Napa winery officials generally expressed optimism on future prospects, with greater optimism voiced for varietals than for standard wines--that is,

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1/ Farrell, "The California Wine Industry: Trends and Prospects," Testimony presented at a public hearing to consider amendment of the State of California Marketing Order for Wine, San Francisco, California, March 2, 1966 (Berkeley: Agricultural Extension Service, 1966), p. 7.

2/ Thus, a 2.5 percent increase in per capita income would yield a 1.0 percent increase in per capita consumption of table wine. The population effect and income effect would be (1.015)(1.01) = 1.025.

for premium over lower quality table wines.[1/] (A limitation on expansion stems from the wide variety of individual state taxes, controls, and restrictions on the sale of alcoholic beverages. Thus, Business Week notes a trend toward increased size of wineries: "Contributing to this trend is a jungle of distribution problems involving principally controls slapped on by each of the states. As a result, some small vintners don't bother--or can't afford--to ship outside California."[2/])

The general optimism of Napa vintners is shared by Agricultural Extension observers. Thus, James V. Lider noted that "planting of new grapes continues at a steady pace," and "it appears we have an expanding grape industry oriented to producing premium wines" in his 1965 review of the Napa situation.[3/] John N. Fiske forecast plantings of 1,000 acres of premium grapes per year in the period 1965-1970.[4/] This would yield an expansion of average Napa production by about 50 percent when the acreage increment comes into production by the early 1970's (Table 14).

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1/ A varietal wine is one stating the kind of grape from which it is made. Under federal regulations, a wine maker may use a name indicative of a grape variety "if the wine derives its dominant taste, aroma, and characteristics, and at least 51 percent of its volume from that variety of grape"; see M. A. Joslyn and M. A. Amerine, Dessert, Appetizer and Related Flavored Wines: The Technology of Their Production (Berkeley: Division of Agricultural Sciences, University of California, 1964), p. 9. In general usage, "varietal" refers to high-quality, high-priced grapes and wine and "standard," to lower quality, lower priced grapes and wine; see Wines & Vines, Vol. 46, No. 9 (September, 1965), p. 21, for a short list of North Coast varietal and standard varieties and corresponding prices per ton.

2/ Business Week, August 10, 1963, p. 84.

3/ Lider, op. cit.

4/ John N. Fiske, Napa County Farm Advisor, "Farm Advisors Report on 1964 Grape Crop in California's Major Grape Counties," Wines & Vines, Vol. 46, No. 2 (February, 1965), p. 31.

A 10 percent increase in production per year, assuming Farrell's 1.5 percent increase in population, implies an 8.9 percent increase in per capita consumption of Napa premium wine per year. Given a 2.5 percent annual increase in real per capita income, this implies an income elasticity of 3.6 for Napa premium wine. This is a very high income elasticity relative to agricultural commodities in general.[1/] It may, in fact, hold for Napa County wine, which comprises only part of the premium wine market. However, there is marked expansion in premium wine plantings in new areas of the state (San Benito and Monterey counties, Table 10). This may mean that premium wine supply increases will be greater than demand increases in the short run, with some attendant price reduction and consequent slowing down of expansion in Napa plantings. John Fiske noted that Napa premium wines were in very short supply as of early 1967, with some rationing of supply even to old customers and some likely price increases as a consequence.[2/]

If one were to attempt long-run forecasts of the Napa wine market, however, it might be prudent to assume an income elasticity of demand no greater than 1.5.

Grape Land Preservationism

Napa County is on the periphery of the San Francisco urbanized area. Its recent population growth, in relative terms, has been well below that of Bay area counties where rapid suburbanization is occurring (Table 4). A number of

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1/ Beef sirloin, lamb, and mutton have income elasticities of about 1.5; see T. W. Schultz, The Economic Organization of Agriculture (New York: McGraw-Hill Book Company, Inc., 1953), p. 73. Most agricultural commodities have income elasticities below 1.0.

2/ Conversation with John Fiske, Napa County Farm Advisor, January 12, 1967.

observers, however, has anticipated greatly expanded population growth, subdivision, and housing development in Napa County in the next 10-20 years. This was expected to be concentrated in the Napa Valley, moving north from the city of Napa to St. Helena and Calistoga. Such a development would clearly have an important impact on grape and wine production. Many viewed this with alarm. For example, the New York Times editorialized:1/

> "Every year the bulldozers . . . swallow up several hundred thousand acres of once green countryside for new suburbs, new shopping centers and new highways. . . . So great are the purely financial reward of this kind of urban expansion that even the sundrenched Napa Valley . . . is seriously threatened. Vineyards are less profitable than subdivisions. . . . It is not too late . . . to save the countryside and establish . . . a green legacy for tomorrow."

In 1964 Harold Gilliam wrote: "Now threatened [by urban sprawl] are the vineyards of Napa and Sonoma, to be followed eventually by the crops of every other agricultural valley in the state."2/

Again, in 1966, the San Francisco Examiner argued:3/

> "The Napa and Sonoma county vinelands are among the distinctive characteristics of the San Francisco Bay Area. They are invaluable elements of the economy and the color of this region. Safeguarding them against the inroads of suburbanization is a compelling duty that rests alike upon planners, politicians, those who govern and the public."

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1/ "The Green Legacy," New York Times, Editorial, January 9, 1965, p. 24.

2/ Harold Gilliam, This World in San Francisco Chronicle, August 16, 1964; also see similar comments by Gilliam, San Francisco Sunday Chronicle, March 14, 1965: "The [Napa] Valley will become indistinguishable from sleazy suburban developments all over the Bay area," and San Francisco Sunday Examiner and Chronicle, October 30, 1966: "Drive north through the Napa or Sonoma Valleys, not yet inundated by the tide of urbanization, where the autumn leaves of the vineyards are turning the hills and valleys to russets and reds and purples. Ask yourself if these sights are worth preserving."

3/ San Francisco Examiner, Editorial, Section II, April 24, 1966, p. 2.

In that year, William Bronson proposed the development of a Napa Valley National Vineyard, essentially an extension of the national park idea.[1/] He argued:

> "We have created national seashores, national historical monuments, national recreational areas, national parks and wilderness areas. Why should we not set aside national agricultural reserves. And where better could we begin examination of the national responsibility in this field."

This would be implemented through the acquisition by a government agency of development rights to a large tract of land in the Upper Napa Valley, encompassing 40,000-50,000 acres. By sale of development rights, the landowner would then be prohibited from using the land for urban purposes; thus, non-agricultural structures could never be built on the land.

In April, 1968, the Napa County supervisors passed an amendment to the County zoning ordinance creating an agricultural preserve in Napa Valley.[2/] The Agricultural Preserve District encompasses roughly 20,000 acres and extends from 1 mile north of the city of Napa limits to the Calistoga area. The ordinance applied to land zoned for agriculture; areas previously zoned residential, commercial, or industrial were not affected. In the Preserve, single lot dwellings are allowed, but lot size must be 20 acres or more. This was a major change from previous zoning, which set a minimum lot size of 1 acre. The zoning ordinance was set up to be applicable under the Williamson Act.

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1/ William Bronson, "A Proposal: The Napa Valley National Vineyard," Cry California, Vol. 1, No. 3 (Summer, 1966), pp. 14-16.

2/ The Agricultural Preserve was set up under Napa County Ordinance No. 274. Information on the Preserve and the Ordinance was obtained from San Francisco Chronicle, April 11, 1968, p. 6; The Los Angeles Times, April 22, 1968, p. 28; The American Society of Landscape Architects, Northern California News (newsletter), Vol. 1, No. 3 (April, 1968), p. 1; letters from L. T. Wallace, April 18, 1968; William Bronson, April 23, 1968; John Fiske, April 24, 1968; Vernon S. Cotter, April 25, 1968, to Irving Hoch; and telephone conversation with John Fiske, February 4, 1969.

Under that Act, given a designated Agricultural Preserve, a farmer may sign a contract with the county in which he agrees to retain the land in agricultural use for 10 years. In return, the county agrees to assess the land on the basis of its value in agricultural use, notwithstanding possibly higher value in urban use.[1/] In addition, California legislation in 1967 exempted land set aside under the Williamson Act from the state's assessment reform law, which required assessment at 25 percent of market value. Landowners withdrawing from the agreement during the 10-year period are subject to heavy financial penalty, and there is automatic annual renewal of the agreement unless designated action is taken by either party.

In April, 1968, a Napa County supervisor forecast that more than half of the acreage in the Preserve would be covered by Williamson Act agreements within two years of its establishment.[2/] However, initial agreements under the Act were not made until early 1969, and coverage remained low as of Fall, 1969, indicating a much slower rate of coverage.[3/]

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1/ A short description of the Williamson Act (California Land Conservation Act of 1964) appears in J. H. Snyder, "California Land Conservation Act of 1965 . . . a new approach to problems of agricultural land use," California Agriculture, Vol. 19, No. 9 (September, 1965), pp. 3 and 4.

2/ The Los Angeles Times, April 22, 1968, p. 28 (attributed to Jack Ferguson).

3/ John N. Fiske has suggested some apparent reasons for this slow rate--there would be little or no short-run tax relief for high-valued yineyard lands and there would be an excessive amount of tax relief (from the County's standpoint) for lower valued hill lands. Fiske noted: "The Assessor pointed out [to growers] that there would be no immediate tax relief as far as vineyards were concerned but that it could be very helpful in the future as pressure from urbanization increased and comparable land sales reached figures of $8-10,000 per acre. Most operators with whom I have talked, however, are not anxious to tie up their land and execute agreements on potential benefits that lie some time in the distant future. . . . Napa County has been proceeding very slowly in extending the agricultural preserve idea to hill lands . . . County officials are concerned that the demand for agreements on hill lands would be so great as to materially undermine the tax base of the county. They are therefore considering ways and means of limiting preserves on hill lands to those areas actually engaged in commercial livestock or timber production." Personal communication from John N. Fiske, Agriculturalist Emeritus, Agricultural Extension Service, Napa, California, to David A. Clarke, Jr., Director, Giannini Foundation of Agricultural Economics, University of California, Berkeley, October 4, 1969.

The establishment of the Preserve, implying long-term stability of land use, appears to have generated a good deal of vineyard investment. In some previously high risk cases, capital invested per acre (roughly $1,500) can now be amortized, given the certainty of grape production for at least 10 years. As a consequence, the estimate of plantings of 1,000 acres per year could turn out to be conservative.

The establishment of the Preserve may also have an impact on planned highway routing. The State Division of Highways is planning a six-lane highway across the floor of the Upper Napa Valley. A discussion with State Division of Highway officials developed the points that the highway will not be started until some time after 1972; and if local official bodies really wanted changes in the routing of the planned freeway, they could probably effect such changes through the aegis of the State Highway Commission reconsidering the case, based on local recommendation.[1/] Such recommendation may be forthcoming, given the Preserve.

In assessing the Preserve, William Bronson wrote:[2/]

> "I do not believe that the action of the supervisors, however forward thinking and courageous they may have been, will result in a permanent protection of the prime lands of Napa County. Zoning is always subject to the shifts in political wind, and the board of supervisors may be filled with all new faces after the next election. The current supervisors were subject to intense economic and personal pressures to vote against the creation of the district. . . . Generally, I view the ordinance as a holding action of major importance. But if we mean to save the Napa Valley (and indeed much of the remaining prime soils of our coastal valleys) we must look to the establishment of state and/or federal policy and programs that will hold these lands for agriculture into perpetuity."

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1/ Conversation with Mr. Robert Jahrling, State Division of Highways official, December, 1966.

2/ Letter from William Bronson, April 23, 1968, to Irving Hoch.

Bronson's comments help bring into focus the motivations of diverse interest groups in supporting preservation at present. Some of these interest groups may not support preservation in the long run.

Those who do support long-term preservation include conservationists and some of the Napa County wine producers loath to relocate or go out of business. It seems obvious that tourists (and potential tourists) have similar interests. The conservation position involves the value judgments that urban sprawl is bad and that open space is good. Further, open space in the form of Napa vineyards is seen as especially pleasing on aesthetic grounds. Thus, Donald de la Pena argued:1/

> "The wine and vine lands that are the most desirable to save are in Napa and Sonoma counties. . . . In general, these counties offer the most aesthetically pleasing and the most historically oriented vineyards and wineries."

He also noted:

> "I am not primarily concerned with preserving vineyards and wineries for the economic gain of certain agriculturalists or wine producers."

Conservationists feel their position has broad appeal and is in the public interest. It might be noted, however, that enthusiasm for their position is generally concentrated in middle and upper income groups.2/

In terms of financial rationality, farm people would be motivated to retain owned land in an area of urban expansion so long as the rate of increase in land value exceeded their alternative investment opportunity rate (for

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1/ Donald J. de la Pena, Preservation of Vineyards and Wineries in the San Francisco Bay Area (published Master's Thesis, College of Environmental Design, University of California, Berkeley, 1962), pp. 36 and 57.

2/ Arnold W. Green, Recreation, Leisure and Politics (New York: McGraw-Hill Book Company, Inc., 1964), 193p; and Aaron Wildavsky, "Aesthetic Power or the Triumph of the Sensitive Minority Over the Vulgar Mass: A Political Analysis of the New Economics," Daedalus, Vol. 96, No. 4 (Fall, 1967), pp. 1115-1128.

example, the market rate of interest). People concerned with the agricultural economic interest would not be too concerned with the aesthetic argument. Thus, Professor J. Herbert Snyder, who helped draft the Williamson Act, describes its goals as follows:[1/]

> "It is aimed at agricultural land; it is aimed to allow the necessary conversions from agricultural to non-agricultural use that are going to have to occur in the state of California. . . . We do not design the program with the thought that we would be preserving museum pieces in agriculture. . . . All we want to do is to make it possible for people to engage in agriculture so long as the totality of economic forces suggests that this is to their advantage and to make the tax pressure no longer the one single criteria that determines land use conversion."

It seems likely that in 10 years or so, many landowners favoring preservation now would become interested in selling their land for urban use. The interest would be expressed in terms of withdrawal from Williamson Act participation and in support for zoning modifications. (Some landowners, in fact, do not want to wait 10 years. Thus, a suit against the Agricultural Preserve zoning has been filed; as of this writing, it has not been decided. On the other hand, some operators of vineyards take a long-term conservation position. They may not be concerned with pecuniary maximization per se but may treat the production of wine in Napa County as a "calling," being willing to forego some income in order to remain in production in Napa. But it seems likely that a great many operators attach primary weight to income considerations.) Hence, the purchase of development rights and the establishment of a Napa Valley National Vineyard remains an important alternative. Its possible implementation has been moved forward in time. This may be both a help and a hindrance to that implementation. It may be a help because our society is likely to be

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1/ Napa County Economic Study Conference, Calistoga, California, Proceedings of the Napa County Economic Study Conference, November 3, 1965 (Napa, California: Napa County Agricultural Extension Service, 1965), pp. 25 and 67.

more affluent in the future, so that taxpayers would be more willing to bear the costs involved. It may be a hindrance because the purchase price of development rights can be expected to increase over time, reflecting the building up of demand for land for urban uses. (Indeed, as hypothesized above, the growth rate of land value is probably above the interest rate.)

In an attempt to survey the attitudes of Napa County residents toward a National Vineyard, a survey questionnaire was mailed to samples of 500 residents, 500 farmers, 64 "community leaders" (based on attendance at a study conference), and the 15 wineries of the field study discussed above (the survey date was 1967). Replies were received from approximately 100 each of the residents and farmers and from 20 leaders and 6 wineries. Table 25 exhibits responses (in terms of for, against, and unsure) with respect to (1) the general idea of preservation and (2) the idea of a National Vineyard. It turned out that 77 percent of all respondents were in favor of "wine and vine land" preservation in general, but only half of the respondents were for the National Vineyard.

When respondents were categorized by group, the general idea always fared better than the specific. It is of interest, however, that city of Napa residents' favorable replies dropped from 79 percent to 66 percent, while farmers' favorable replies dropped from 75 percent to 39 percent, in moving from the general idea to the specific idea of the National Vineyard. This might well reflect divergence of long-term interests between those groups.

Table 26 lists averages of estimated "proper" price for development rights to land in the tract in terms of land owned by the respondent (if, in fact, he were a landowner) and in terms of land in general in the tract. All broad groups (residents, farmers, and leaders) priced their own land above the general run of land in the proposed preserve. Persons for the National Vineyard, however, reversed these relative values.

TABLE 25

Distribution of Responses to General and Specific Preservation Ideas by Group
Napa County

Group and preservation idea	For	Against	Unsure	"For" replies as fraction of all listed replies
All replies				
General idea[a/]	164	28	19	.774
National Vineyard[a/]	103	64	37	.505
Residents				
General idea	71	14	6	.780
National Vineyard	56	26	7	.629
Farmers				
General idea	70	13	11	.745
National Vineyard	35	31	23	.393
Leaders				
General idea	17	1	2	.850
National Vineyard	9	6	5	.450
Wineries				
General idea	6	0	0	1.000
National Vineyard	3	1	2	.500

(Continued on next page.)

TABLE 25--continued.

Group and preservation idea	For	Against	Unsure	"For" replies as fraction of all listed replies
Landowners				
General idea	55	13	10	.705
National Vineyard	26	29	19	.351
Calistoga and St. Helena residents				
General idea	9	2	2	.692
National Vineyard	5	7	0	.417
City of Napa residents				
General idea	56	12	3	.789
National Vineyard	47	18	6	.662

a/ Row totals are not the same and do not add to overall total because of a small number of "do not care" responses and omitted replies.

Source: Survey questionnaire replies.

TABLE 26

Averages of Estimated "Proper" Price for Land Development Rights
by Group and Class of Land, Napa County

Group replying	Average of estimated "proper" price per acre for development rights to land		Number in sample	Number answering question on average value
	Owned land	Average land in tract		
	dollars			
All	3,125	2,800	215[a/]	106
Residents	3,750	3,356	93	46
Farmers	2,978	2,382	96	50
Leaders	3,250	2,491	20	10
Persons for National Vineyard	2,688	2,928	103	56
Persons against National Vineyard	3,617	2,473	64	28
Persons unsure about National Vineyard	3,232	2,889	48	22
Persons owning land	3,149	2,532	79[b/]	44
Persons not owning land	[c/]	2,990	121[b/]	62

a/ Difference between total and sum of subtotals equals six and represents winery replies.

b/ Does not add to 215 because some replies did not answer question on land ownership.

c/ Not applicable.

Source: Survey questionnaire replies.

It is of interest that the development rights overall estimate is $2,800 per acre, which is somewhat above the estimate developed above for current market value of Napa grape land. A number of explanations are possible: (1) both estimates are sound, so that most people would expect to sell only when price per acre reached about $5,000;[1/] (2) the respondents tended to identify development rights value with total land value;[2/] and (3) the prior estimate of land value is low.

At a price of $2,800 for development rights, a 50,000-acre preserve would cost $140 million.

It should be noted in conclusion that, if development rights are not purchased and if an attempt is made to continue the Agricultural Preserve by means of zoning, then it is likely that (1) pressure will build up to modify or eliminate the zoning and (2) if the pressure is resisted, landowners in effect will be asked to bear the costs of keeping the land in agricultural use. The equity of such an arrangement seems open to serious question, since most of the benefits accrue to others.

It may be added that the interests of potential residents tend to be neglected in the preservation discussion. Perhaps it is felt the relevant supply of agricultural land for conversion to urban uses is very elastic, so that increased costs to such persons are very low. But this argument is open to question. In particular, it is often argued that development might well shift to

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1/ The $5,000 figure is obtained by adding the $2,800 for development rights to about $2,200 for present value in agriculture. Presumably, $5,000 is a high enough supply price so that almost all landowners would be willing to sell at that price.

2/ This appears to involve some confusion if present value consists of capitalized net returns to the land in agriculture plus discounted value of probable returns in future urban use above the agricultural value. However, one respondent wrote: "I think development rights are worth as much as the land is worth."

the hills above the Napa Valley floor. But hillside building is a good deal more expensive than building on valley floors.[1/] In general, then, losses in utility or increases in costs to potential residents are a final offset item to consider in benefit-cost calculations for the National Vineyard or for permanent Agricultural Preserve zoning.

OTHER KEY GROWTH SECTORS

Introduction

Grape and wine production, discussed above, is a major sector influencing the economic future of Napa County. Other key sectors are discussed in this section and, insofar as possible, an attempt is made to assess their future impact on the economy. The sectors singled out for attention here are (1) Lake Berryessa recreation; (2) the housing market--in particular, residential development reflecting the impact of population growth and suburbanization; and (3) consumer spending as a function of income--in particular, spending within versus outside the County as income increases.

Lake Berryessa Recreation

Lake Berryessa was discussed briefly above. Because the Lake and attendant developments are likely to have great impact on the Napa economy, a detailed discussion is in order.

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1/ Jack Lessinger, "Exclusive Agricultural Zoning: An Appraisal, Part II: Comparative Advantage," Land Economics, Vol. 34, No. 3 (August, 1958), pp. 225-262.

A recapitulation of some basic statistics about the Lake can be had by drawing on a paper by Waelti:[1/]

> "Lake Berryessa, the key feature of the Bureau of Reclamation's Solano project, is used to store water for irrigation, municipal and industrial purposes. Approximately 31,000 acres of land in Napa County were removed from private ownership, of which 11,000 acres is estimated to have been cropland. . . . To compound this loss, Napa County was allocated only 7,500 acre-feet of water annually of an average annual yield of 262,000 acre-feet, the remainder being allocated to Solano County. The reservoir . . . is approximately 25 miles long and 4 miles wide with an average surface area of 19,300 acres. Its setting in the hills of Napa County and its proximity to the densely populated San Francisco Bay area practically assured its popularity as a recreation center."

Napa County has entered into a 50-year land management agreement with the Bureau of Reclamation concerning the recreation use of the Lake and shore. A Lake Berryessa Park Commission was set up to administer the agreement. A public use plan was prepared; and there is public access to the Lake, with free picnic, swimming, and fishing areas.[2/] Such use is on a day-use basis. In addition, in what seems a pathbreaking venture, a group of recreation activities on a fee basis were set up. The major feature was the subleasing of areas on and around the Lake to seven concessionaires for resorts and tourist facilities.[3/] The conncessionaires pay 3 percent of their gross receipts to the Park Commission as a franchise fee. Additional income is obtained from

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1/ John J. Waelti, "Some Effects of Reservoir-Based Recreation on Local Government Finance," Paper presented at the Western Farm Economics Association Annual Meeting, Los Angeles, California, August 15, 1966 (Berkeley: Giannini Foundation of Agricultural Economics, University of California, 1966), p. 2.

2/ Much of the descriptive material following is based on an interview with Mr. H. D. Adams, Park Director, March, 1966.

3/ The concessionaires are the Markley Canyon Resort, Wragg Canyon Resort, Steele Canyon Resort, Spanish Flat Resort, Berryessa Marine Resort, Rancho Monticello Resort, and Putah Creek Part. (This list was furnished by Mr. Adams.)

use permits and from grazing fees. (On the eastern shore of Lake Berryessa, 3,000-4,000 acres are allocated to grazing use only. The east side has gentle contours, and it is not feasible to develop it at present because of the danger of flooding. There is a possibility that the Lake will be stabilized at approximately a constant water level as a concomitant of future water development. In this event, the development of the east side will become feasible.)

Lake Berryessa use estimates are made daily by the Park Commission, with monthly and yearly recapitulation. Listed visitor days show a good deal of year-to-year variation; the total was 1.8 million in 1964 and 1.2 million in 1965.1/

Most of the visitors are from outside the County, with Napa County residents accounting for somewhat less than 5 percent of the total. Estimates of visitor source by residence are San Jose and Peninsula, 10 percent; San Francisco and South San Francisco, 10 percent; East Bay, 50 percent; Vallejo-Vacaville-Winters-Davis, 20 percent; Sacramento, 5 percent; Napa, 4 percent; and the rest of California and the United States, 1 percent. It is expected that southern California visitor use rates, in particular, will increase over time. The large outside usage of about 95 percent holds for both free and fee usage.

In 1965 there were eight persons employed in park recreation operation and maintenance. In addition, approximately 100 full-time equivalent employees (on an annual basis) worked for the seven concessionaires. Perhaps 85 percent of this employment consists of persons coming into Napa from outside the area.

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1/ Visitor days totaled 1.4 million in 1966, 1.6 million in 1967, and 1.8 million in 1968. (Letter from Mr. Gilbert Yates, Park Director, February 7, 1969.)

Receipts and expenditures of the Lake Berryessa Park Commission for 1964 and 1965 were on the order of $100,000. Franchise fees in both years were approximately $43,000.[1/] Since franchise fees are assessed at 3 percent of gross sales, this indicates concessionaire sales were about $1.43 million in both years.[2/] Estimated capital values of recreation facilities, as of 1965, were $178,605 for the Park and $4 million for the concessionaire facilities.[3/]

The Lake Berryessa development has had an important impact on local land values and on County finances. The affected tax districts are Monticello and Capell. The assessed value of Monticello declined from 1953 to 1957 (reaching a low of 46 percent of 1953 value in 1957) but then increased thereafter, while Capell increased immediately and continuously, registering a fourfold gain between 1953 and 1965.[4/]

As a consequence, the County gains from increases in the tax base presumably brought about by the project. In addition, increased public revenue

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1/ Receipts and expenditures remained at the $100,000 level for 1966 through 1968. Franchise fees increased over time, amounting to $44,000, $53,000, and $56,000, respectively, for 1966, 1967, and 1968. (Letter from Mr. Yates.)

2/ The substantial importance of these sales in Napa County's economy can be seen from these figures from the 1963 Census of Business:

Sales by hotels, motels, tourist courts, and camps	$1,549,000
Sales by amusement and recreation services	$1,641,000
Sales by eating and drinking places	$6,604,000

U. S. Bureau of the Census, Census of Business, 1963. Vol. 7, Selected Services--Area Statistics, Part 1, U. S. Summary and Alabama to Illinois, 1966, p. 6-49, and Census of Business, 1963. Vol. 2, Retail Trade--Area Statistics, Part 1, U. S. Summary and Alabama to Illinois, 1966, p. 6-55.

3/ U. S. Bureau of Reclamation Form 7-1643, "Recreation and Wildlife Summary, Calendar Year 1965," submitted by the Lake Berryessa Park Commission to the U. S. Bureau of Reclamation for 1965.

4/ Waelti, op. cit., p. 5.

includes "franchise fees, use permits, possessory interest taxes and increased returns through sales taxes."[1/] Further:

> "Funds obtained from franchise fees and use permits, by agreement with the Bureau of Reclamation, must be expended on facilities and services directly related to the recreation area."[2/]

Waelti concluded that by 1965 the estimated discounted gains to the County (benefits minus losses in early years via flooding of productive lands) over 1953-1965 are positive and amount to $150,000. Further, "on the basis of present developments in the Berryessa area, sources of public revenue will increase rapidly in coming years."[3/] This reflects both increased recreation usage and induced housing developments.

Long-range planning by the Lake Berryessa Park Commission involves a forecast of 5 million visitor days per year and a capital investment by concessionaires of around $10 million (compared to the $4 million figure of 1965). Farnum Kerr Associates and Frederick L. Hotes project a 5 million visitor day total for 1981 and a 6.25 million visitor day total for 2010.[4/] Given a 1980 capital investment and visitor level about 2.5 times the 1964-65 level, a forecast of 1980 visitor expenditures of $3.6 million is obtained.[5/]

Recent long-term planning has considered a 400-acre island in the Lake, with facilities including a landing strip, a bridge to the mainland, a hotel

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1/ Ibid.

2/ Ibid., p. 8.

3/ Ibid., p. 9.

4/ Farnum Kerr Associates and Frederick L. Hotes, Napa County Water Needs Study and Plan (Napa, California, 1961), pp. 3, A-14, and A-18.

5/ Thus, $1.43 million of concessionaire sales occurred in both 1964 and 1965; 2.5 times $1.43 million yields $3.6 million.

and motel, and a golf course. The projected magnitude of operations for these developments approximately equal those forecast for the concessionaires, so that the level of future operations noted above can be viewed as a lower bound.

Housing Developments, Land-Use Forecasts and Population Growth

The possible impact of population growth and urbanization upon Napa grape and wine production was discussed above with a focus on grape land preservation. The discussion will continue here as part of a general discussion of population growth and urbanization. Clearly, the continuation of the present Agricultural Preserve for the long term will have some impact on population totals and distribution. Alternative policies include the extremes of (1) the creation of a National Vineyard covering 40,000 acres and (2) removing the zoning restrictions that hold in the Agricultural Preserve and opening upper Napa County to intensive development.

There are some who see marked differences in urban development occurring between the three policies. The best available forecasts, however, indicate that, though some differences in impact do exist, they are not extreme. Much of the County's population growth, even for the relatively distant future, is projected for the southern part of the County and for the Lake Berryessa area in any event.

Details on housing and urbanization will be developed here. This will include a review of land-use forecasts made prior to the creation of the Agricultural Preserve which, in effect, now correspond to a policy reversal situation returning zoning regulations to those that held in the past. Differential impacts of alternative policies on grape land preservation are traced out in the last section of this report as one of the applications of the input-output tables for Napa County.

Recent Housing Developments

Data on new housing units authorized for 1956 through 1967 are presented in Table 27. Napa County and San Francisco-Oakland metropolitan area figures are listed and compared by ratio of the former to the latter.[1/] The ratio was relatively stable from 1956 through 1965, with some decline in the period 1960-1963 and then a return to initial levels by 1965. In 1966-67, the ratio increased markedly. This reflects a marked decline in metropolitan area housing permits in those years, while Napa County exhibited a mild increase. This is suggestive of an upward trend for Napa County in both absolute and relative terms. (The interpretation must be tempered by noting that the metropolitan area decline reflects special conditions--high mortgage interest rates, in particular--prevailing in 1966-67.)

Table 28 presents information on total housing in the County in terms of housing units in 1960 and in 1966 by area within the County. The percentage increase in housing units is about 24 percent. This compares to a population increase of only 18 percent in that period, again suggesting an upward trend.[2/] Presumably, housing developers anticipated some long-term increases. Additional evidence on residential construction was obtained from references to specific projects in a variety of sources. This evidence indicates major construction activity is now in progress in Napa, with much of it located close to Lake Berryessa. However, the full impact of the present construction will not be felt until approximately 1975.

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1/ The Census definition of the Bay area Standard Metropolitan Statistical Area does not include Napa County. The comparison seems useful, however, in contrasting local with wider regional developments.

2/ Based on the regression equation applied to develop the population data of Table 6.

TABLE 27

Number of New Housing Units Authorized by Building Permits
Napa County, 1956-1967

Year	Napa County	San Francisco-Oakland, SMSA[a/]	Napa County relative to SMSA[a/]
1956	582	21,769	.0267
1957	488	18,714	.0261
1958	495	26,994	.0183
1959	750	28,813	.0260
1960	372	28,104	.0132
1961	657	32,664	.0201
1962	725	37,094	.0195
1963	759	42,107	.0180
1964	817	37,982[b/]	.0215
1965	699	31,054[b/]	.0225
1966	739	14,707[b/]	.0502
1967	788	15,566[b/]	.0506

a/ SMSA is the standard Metropolitan Statistical Area as defined by the U. S. Bureau of the Census. The Census does not include Napa County. The comparison is meaningful, given Napa's proximity to the Bay area.

b/ Solano County was included in the SMSA until 1964. After its exclusion, it reduced the total by 5 percent.

Sources:

1956-1958: U. S. Bureau of Labor Statistics, "Building Permit Activity in the San Francisco Bay Area," monthly issues.

1959-1967: U. S. Bureau of the Census, Construction Reports, annual issues.

TABLE 28

Housing Units and Change, Census Divisions and Cities
Napa County, 1960 and 1966

Census division number	Census division	1960 housing units	1966 housing units	Numerical change	Percent change
1	Napa	7,358	9,982	2,624	35.66
2	Napa Northeast	1,928	2,318	390	20.23
3	Napa Northwest	2,338	2,532	194	8.30
4	Napa Southeast	1,791	1,936	145	8.10
5	Napa West	1,590	1,887	297	18.68
6	Angwin	1,032	1,188	156	15.12
7	Lake Berryessa	105	228	123	117.14
8	Calistoga	391	439	48	12.28
	City of Calistoga	604	729	125	20.70
9	St. Helena	690	829	139	20.14
	City of St. Helena	1,040	1,289	249	23.94
	City of Yountville	a/		1	
	Total	18,867	23,357	4,491	23.80

a/ Blanks indicate no data available.

Source: Reproduced from Napa County Planning Department, Population Data of Napa County (Napa, California, 1966), Table 12, p. 23.

Thus, the zoning map of the County exhibits some recent additions in the planned community zoning designation.[1/] Two of these planned community zones lie approximately on a straight line between the city of Napa and Lake Berryessa. Two more lie on the shores of Lake Berryessa--one is at the southern end and the other is at the extreme northern end of one of the reaches of the Lake.

The four planned communities are the Circle Oaks zoned area (2,000 acres), the Berryessa Estate development (1,000 acres), the Steele Park (Berryessa Highlands) development (1,500 acres), and the Silverado Country Club development (4,000 acres). All four developments were zoned between 1963 and 1965. Some details on the Berryessa Highlands and Silverado Country Club cases may be noted.[2/]

The $50 million Berryessa Highlands development covers 1,500 acres on a wooded peninsula on the south side of the Lake. Lots will be restricted to a minimum of 10,000 square feet with a maximum of two lots to the acre. Lot prices range upward from $4,000.

The planning horizon is about seven or eight years with completion projected for 1974 or 1975. Grading and underground utilities development had been completed as of early 1967, and water and sewerage facilities and paving were in process. Roughly 200 sites will be readied for the market each year; of the first block of 200, approximately half had been sold as of early 1967. Most of the purchases to date anticipated use of the site for a summer home.

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1/ Napa County, The County Planning Commission as referenced in Napa County Zoning Ordinance, 1963, p. 3.

2/ "Sites at Lake Berryessa," San Francisco Examiner, May 15, 1966; San Francisco Chronicle, March 17, 1965, and November 14, 1966, Financial Page; and telephone conversations with the Jevne and Evans representative, Sales Agent for Berryessa Highlands, February, 1967, and Mr. Westgate and Mr. Miller of the Silverado Country Club development, February, 1967.

However, a greater proportion of permanent residences are expected to occur as site development becomes more complete.

The Silverado Country Club development will incorporate the golf course of the former country club on the site. It will add an additional 18-hole golf course, wooded homesites surrounding the courses, a luxury hotel, health spa, and convention center. Total value of the development is set at $100 million with completion scheduled for 1975. The development will include a 25-acre shopping center with the balance of the acreage (outside of recreation use) devoted to residential use. A total of 1,300 residential units is projected.

Given a population per household of about three persons[1/] and a total number of year-round homes of 400 for the Berryessa Highlands[2/] and 1,100 for the Silverado development, the population inhabiting these residences will total 4,500 in 1975. This amounts to 6 percent of the 1965 population of 75,700; hence, the two developments will have considerable impact on the Napa economy.

A number of such developments, of course, would be consistent with substantial population growth.

Long-Term Land-Use Forecasts

Donald de la Pena summarizes a Department of Commerce forecasting study regarding the timing, location, and extent of urbanization in wine-growing areas. Parts of the summary applicable to Napa include these statements:[3/]

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1/ U. S. Bureau of the Census, U. S. Census of Population, 1960. Vol. I . . ., pp. 6-67 and 6-197.

2/ Telephone conversation with a Jevne and Evans representative.

3/ de la Pena, op. cit., pp. 55 and 56.

"Urban uses will extend up Napa Valley and encircle the city of Napa by 1970. Ten years later . . ., St. Helena will form a separate regional center. During these two decades the South Bay area will receive the most growth, so that by 1990 it will be almost solidly developed. The Napa Valley north of Yountville will be almost solid with urbanization.

"At the turn of the century the urban area in the Bay counties will be double what it was in 1960. From Vallejo through Napa, Yountville, and St. Helena to Calistoga there will be a continuous urban strip. By 2010 the North Bay counties will be absorbing more of total Bay area growth because the South Bay area will be saturated. . . . In 2020 . . . Napa Valley will be extensively urban, but the Department of Commerce report states that large agricultural patches will remain. Perhaps the department foresaw preserved vineyards in the future urban pattern."

Farnum Kerr Associates and Frederick Hotes developed long-term forecasts in terms of land-use maps.[1/] Their forecasts were developed prior to the creation of the Agricultural Preserve; hence, the forecasts can be interpreted as the situation that will hold if the County returns to the previous zoning arrangement. It is of interest, however, that there is substantial divergence from the Department of Commerce forecast, with much less impact of urbanization on northern Napa County. Given the detailed work involved, primary reliance here will be placed on the Kerr Associates and Hotes forecasts.[2/] Relevant information appears in Tables 29, 30, and 31.

Table 29 summarizes agricultural acreage projected for cropland, pasture, and totals developed by the County Conservation Needs Inventory Committee and quoted by Kerr Associates and Hotes.

Table 30 summarizes Kerr Associates and Hotes agricultural land-use forecasts for 1981 and 2010. There is somewhat more of a drop in acreage by 1981

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1/ Generalized land-use maps for 1961, 1981, and 2010 from Kerr Associates and Hotes, op. cit., following p. 5.

2/ In a telephone conversation with Farnum Kerr, February, 1967, he evaluated the projections as remaining quite reasonable in the light of developments since 1961.

TABLE 29

Projected Agricultural Acreage, Napa County
1960, 1975, 1981, and 2010

Year	Cropland	Pasture	Total
	acres		
1960	45,500	45,000	90,500
1975	36,400	41,400	77,800
1981	33,000	40,000	73,000
2010	15,500	34,000	49,500

Sources:

1960 and 1975: Farnum Kerr Associates and Frederick L. Hotes, Napa County Water Needs Study and Plan (Napa, California, 1961), p. A-21, citing County Conservation Needs Inventory Committee.

1981 and 2010: Projected by Farnum Kerr Associates and Frederick L. Hotes.

TABLE 30

Predicted Acreage in Agricultural Land Use, Napa County
1981 and 2010

Napa County	1981	2010	2010/1981
	acres		
Northern			
Upper St. Helena Creek	30	0	.00
Pope Valley	9,693	6,860	.71
Big Basin	3,070	400	.31
Lake Berryessa	1,280	0	.00
Capell Valley	0	0	.00
Chiles Valley	960	790	.82
Upper Dry Creek	180	0	.00
Sanitarium	210	0	.00
Conn Valley	190	0	.00
Angwin[a/]	2,580	1,520	.59
Calistoga[a/]	4,320	1,770	.41
St. Helena[a/]	4,870	4,130	.85
Oakville-Rutherford[a/]	8,260	7,540	.91
Southern			
Gordon Valley	780	314	.40
Foss Valley	3,070	0	.00
Napa outside city of Napa	9,130	3,250	.36
American Canyon	7,060	0	.00
Carneros	6,610	380	.06
Mt. Veeder	200	180	.90
Yountville	3,770	2,580	.68
Total			
Northern	35,643	23,010	.65
(Major grape-producing areas)	(20,030)	(14,960)	(.75)
Southern	30,620	6,704	.22
TOTAL	66,263	29,714	.45

a/ Major grape-producing area.

Source: Farnum Kerr Associates and Frederick L. Hotes, Napa County Water Needs Study and Plan (Napa, California, 1961), land-use maps following page 5.

TABLE 31

Projections of Residential, Industrial, and Commercial Land Use for Selected Areas, Napa County, 1961, 1981, and 2010

Area and year	Residential[a]			Industrial	Regional retail center
	Low density	Medium density	High density		
Vineyard areas					
Calistoga					
1961[b]	400	400	0	0	Yes
1981	900	820	0	0	Yes
2010[c]		3,820	0	0	Yes
St. Helena					
1961[b]	540	490	0	60	Yes
1981	920	1,490	0	255	Yes
2010[c]		3,670	0	290	Yes
Oakville-Rutherford					
1961[b]	0	0	0	0	No
1981	620	0	0	0	No
2010[c]	1,740	0	0	0	No
Lake Berryessa areas					
Lake Berryessa					
1961[b]	0	0	0	0	No
1981	2,540	740	0	0	Yes
2010[c]			0	0	Yes
Capell Valley					
1961[b]	0	0	0	0	No
1981	1,720	720	0	0	Yes
2010[c]	3,370		0	0	Yes

a/ Density is defined in terms of space per dwelling unit. Low density: 1/2 to 5 acre parcels. Medium density: 5,000 square feet to 1/2 acre parcels (21,780 square feet). High density: less than 5,000 square feet per dwelling unit.

b/ Values estimated from land areas shown on land-use maps.

c/ Values are highly aggregated; generally only one density class is ascribed to a particular area. Subareas with differing density levels will not be shown.

Source: Farnum Kerr Associates and Frederick L. Hotes, Napa County Water Needs Study and Plan (Napa, California, 1961), land-use maps following p. 5.

and substantially more of a drop in acreage by 2021 than in the forecasts presented in Table 29. However, a good deal of land is retained in agriculture in the major grape-producing areas of the County. Viewing the land-use maps, the impact of urbanization seems much more pronounced in the southern part of the County than in the northern part for 1981 relative to 1961.[1/] This pattern also holds for 2010 relative to 1981 as is indicated in Table 30.

Total acreage in 1981 is projected as 73 percent of the 1960 level, accepting the 1960 figure given in Table 29. Agricultural land use in 2010 is 45 percent of the 1981 level for the County as a whole, 22 percent in the south, and 65 percent in the north. Of particular interest is the percentage for major grape-producing areas; this is shown as 75 percent of the 1981 level.

Total acreage in the major grape-producing areas is about 15,000 acres. This is above present acreage in vineyards and equals the acreage projected by John N. Fiske, as of the early 1970's, as noted above.

Kerr Associates and Hotes indicate that the major impact of urbanization is expected in orchards, hay, and grain, with much less impact on grape production. Thus, "declines in orchards, and hay and grain should continue at a relatively high rate with the land utilized by more or different 'intensive' agricultural use, i.e., vineyards, truck and special crops, and perhaps walnuts. . . . Of special note is the probable retention of vineyards on small farms as well as on large farms. . . . There can be an anticipated increase in <u>proportion</u> of vineyards, truck and special crops, walnuts, and pasture."[2/]

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1/ This cannot be given quantitative expression because acreage values are not shown explicitly in the 1961 land-use map.

2/ Kerr Associates and Hotes, <u>op. cit.</u>, pp. A-22 and A-23.

Projections of residential and industrial use and the occurrence of projected regional retail centers are given on the Kerr Associates and Hotes land-use maps. Of particular interest are projections made for the major wine-growing areas and for the Lake Berryessa area (the Berryessa and Capell districts). These projections for 1981 and 2010 and estimates inferred from the map areas for 1961 are presented in Table 31. (The 2010 values are highly generalized and aggregated, so that the kind of detail found in the 1961 and 1981 figures is not carried over to the 2010 projections.)

If the Agricultural Preserve zoning is still in effect in 1981 or if the National Vineyard has been implemented, some estimate of their impact can be based on the vineyard areas section of Table 31. For either case, the increments of nonagricultural land use by type will be affected. The 1981 increments are 1,500 acres in low-density residential use, 1,420 acres in medium-density residential use, and 195 acres in industrial use for a total of 3,115 acres. In the National Vineyard case, these increments will not occur; in the Agricultural Preserve case, an increment will occur only in very low-density housing. Detailed consequences are traced out for these alternative cases in the final section of this report.

Population Forecasts

A number of population forecasts for Napa County have been made by various agencies; these are collected and exhibited in Table 32.

Forecasts made prior to 1960 are compared with 1960 actual population as is the State Department of Finance forecast for 1965. There appears to be some tendency for forecasts to be on the high side. This probably reflects a current

TABLE 32

Estimated and Forecast Population, Napa County

Source of population figure	Population						
	1960	1965	1970	1980	2000	2010	2020
	1,000 persons						
Actual	66.4	75.7	a/				
Forecast:							
(a) State Department of Finance		77.0	88.2	115.6	--b/	--	--
(b) U. S. Office of Area Development	67.0	--	80.0	120.0	280.0	430.0	660.0
(c) San Francisco Bay Area Rapid Transit Survey							
High	81.0	--	126.0	170.0	--	--	--
Low	68.0	--	87.0	105.0	--	--	--
(d) U. S. Bureau of the Census							
High	74.0	--	100.0	171.0	375.0	504.0	--
Low	71.0	--	90.0	130.0	229.0	281.0	--
(e) State Department of Water Resources	66.0	--	100.0	145.0	300.0	390.0	475.0
(f) Watershed Work Plan, Napa County	--	--	--	170.0	--	--	--
(g) Farnum Kerr Associates and Frederick L. Hotes	--	--	--	149.7	--	399.7	--
(h) California Outdoor Recreation Plan	--	--	--	133.9	--	--	--
(i) Napa County Planning Department							
(1) Using 3 percent growth rate			--	117.9	212.9	286.1	384.5
(2) As percent of California forecast--constant inmigration rate			--	117.5	176.0	--	--
(3) As percent of California forecast--decreasing inmigration rate			--	115.4	162.0	--	--
(j) Linear regression result	66.2	75.8	85.3	104.3	142.4	161.4	180.4
(k) Result using 2.5 percent growth rate			--	110.0	181.0	232.0	300.0

(Continued on next page.)

TABLE 32--continued.

a/ Blanks indicate not applicable.

b/ Dashes indicate not listed or not calculated.

Sources:

Actual figures: As of July 1; California Department of Finance estimates (Sacramento).

Forecast figures:

(a) California Department of Finance, Financial and Population Research Section, "Provisional Projections of California Areas and Counties to 1980," Special Report (Sacramento, 1963), p. 3.

(b) U. S. Office of Area Development, "Future Development of the San Francisco Bay Area, 1960-2020," 1959, Table 7 (adjusted projections), p. 22, and Table 5 (projections not adjusted for cyclical variation), p. 17. Figures in Table 5 are reproduced in a number of sources. Differences between Table 5 and Table 7 are minor.

(c) Donald J. de la Pena, Preservation of Vineyards and Wineries in the San Francisco Bay Area (published Master's thesis, College of Environmental Design, University of California, Berkeley, 1962), p. 50.

(d) L. T. Wallace and John W. Mamer, Napa County: Selected Economic Data, University of California Agricultural Extension Service (Berkeley, 1966), p. 8.

(e) Farnum Kerr Associates and Frederick L. Hotes, Napa County Water Needs Study and Plan (Napa, California, 1961), p. A-10.

(f) Ibid.

(g) Ibid., p. A-17; figure in 1980 column is for 1981.

(h) California Public Outdoor Recreation Plan Committee, California Public Outdoor Recreation Plan, Part II (Sacramento, 1960), Table 3 and Appendix Tables N and O.

(i) Napa County Planning Department.

(1) Based on state rate of increase since 1960.

(2) Estimate for Napa County as percent (0.42 percent) of state of California population projection assuming a constant rate of net inmigration [Department of Finance, Revenue, and Management Agency, California Population Projections, 1965-2000 (Sacramento, 1966), 26p.].

(3) Estimate for Napa County as percent (0.42 percent) of state of California population projection assuming a decreasing rate of net inmigration [Department of Finance, Revenue, and Management Agency, California Population Projections, 1965-2000 (Sacramento, 1966), 26p.].

(j) Regression equation of Table 14, supra, p. 33.

(k) Rate suggested in this study to allow for current declining birth rate.

general hazard of population forecasting; United States population growth in recent years has been well below expectations. (More recent forecasts may be beginning to reflect this drop in growth rate. Thus, in Table 32 compare the recent Napa County Planning Department forecasts with those made earlier.)

In Table 32, as the forecast date moves forward in time, the spread among forecasts increases. This is not surprising; aside from increased uncertainty with increasing time of forecast, there is the effect of carrying a compounding growth process forward in time.

The 1980 forecasts range from 105,000 to 171,000. (The low value is very close to that obtained by applying the linear regression result given in Table 6 of this study, which is shown in Table 32 for comparative purposes. The linear trend is defensible only for a short time span.) In terms of fraction of 1965 population, the 1980 figures range from 1.387 to 2.259.

Given the present declining United States birth rate, a 1980 estimate of 110,000 seems "reasonable." This lies between the State Department of Finance estimate and the low estimate. This figure implies a 2.5 percent compound growth rate for population. Using that growth rate, a year 2000 forecast of 181,000 and a year 2020 forecast of 300,000 are obtained. In terms of fraction of 1965 population, 1.453, 2.391, and 3.963 are obtained for 1980, 2000, and 2020, respectively.

Consumer Spending

A survey of consumer spending and recreation activity was carried out in connection with the present study. A total of 500 questionnaires were mailed to Napa County residents, and 84 replies were received. Of these, 63 could be used in developing information on consumer spending.

Table 33 lists the allocation of income to saving, taxes, and consumer spending by locale for the sample of 63 replies. It is of interest that the distribution of consumption expenditures appears to shift from Napa to outside the County as income increases. The information in Table 33 is affected by small sample size and, hence, there is some instability in pattern; however, the percentage of spending in Napa appears to drop from somewhat above 90 percent at lower income levels to about 80 percent for high-income levels. This can be interpreted as implying that, as Napa County income increases, spending by residents within the County will increase at a somewhat slower rate.

Table 34 lists some detailed information on consumer spending for four aggregated income classes in terms of dollars spent. Table 35 restates this information in terms of fractions of income. The income classes here consist of (1) from $5,000 to $7,999, (2) from $8,000 to $10,999, (3) from $11,000 to $24,999, and (4) $25,000 and over. The data are useful in indicating general patterns of consumer spending in Napa County. However, because of small sample size and variation in interpretations of questions by respondents, it must be used with some care. Hence, supplemental information from other sources is advisable in analyzing consumer spending.

TABLE 33

Allocation of Income to Savings, Taxes, and Consumer Spending by Locale for a Sample of Napa County Residents

Income class	Average income	Fraction of income to:							Distribution of consumption expenditures by locale		
		Savings	Taxes			Consumer spending					
			Federal	State	City and county	Napa County	Bay area	Elsewhere	Napa County	Bay area	Elsewhere
dollars											
5,000- 5,999	5,700	.087	.122	.004	.036	.735	.004	.013	.977	.006	.017
6,000- 6,999	6,633	.050	.060	.003	.040	.693	.139	.015	.818	.164	.018
7,000- 7,999	7,292	.024	.091	.004	.039	.787	.010	.046	.934	.012	.054
8,000- 8,999	8,465	.060	.093	.004	.034	.745	.053	.012	.920	.065	.015
9,000- 9,999	9,730	.037	.084	.004	.039	.729	.050	.057	.871	.060	.069
10,000-10,999	10,425	.065	.103	.009	.036	.673	.058	.057	.853	.074	.073
11,000-12,999	12,026	.044	.103	.005	.033	.720	.064	.030	.885	.078	.037
13,000-14,999	14,000	.066	.122	.011	.027	.691	.063	.020	.893	.081	.026
15,000-24,999	18,436	.078	.181	.025	.039	.540	.059	.078	.798	.086	.116
25,000 and over	53,300	.202	.272	.044	.027	.360	.071	.025	.790	.155	.055

Source: Sample of 63 respondents in survey of consumer spending carried out in this study.

TABLE 34

Detailed Information on Consumer Expenditures for a Sample of Households
Napa County: Expenditures in Dollar Terms

Category	Income range within income class			
	$5,000-$7,999	$8,000-$10,999	$11,000-$24,999	$25,000 and over
Number of respondents	12	25	22	4
	dollars			
Average income in class	6,597	9,396	14,805	53,303
Allocation of income[a/]				
Savings	321	522	974	10,751
Federal tax	607	884	2,099	14,498
State tax	26	54	231	2,351
City and county tax	254	337	505	1,423
Consumption expenditures				
Napa County	4,934	6,723	9,358	19,173
Bay area	267	507	905	3,774
Elsewhere	188	369	733	1,333
Napa County consumption				
Food	1,280	1,933	2,358	3,097
Clothing	404	445	527	1,572
Furniture	214	379	502	938
Insurance	272	303	720	2,372
House repairs	127	251	292	3,022
Laundering and cleaning	107	96	169	613
Rent	830	1,209	1,479	2,281
Legal and medical	330	303	460	544
Gasoline and oil	316	399	465	581
Auto maintenance	133	132	326	208
Utilities	270	350	423	283
Recreation	125	249	604	762
Automobile purchase	393	311	496	[b/]
Other	133	362	534	2,899
Bay area consumption				
Food	80	90	86	
Clothing	58	90	187	677
Furniture[c/]	42	103	73	437
All other	87	224	559	2,660
Consumption elsewhere				
Food	2	39	53	123
Clothing	1	1	33	
Furniture[c/]		8		
All other	185	321	647	1,210

(Continued on next page.)

TABLE 34--continued.

a/ Averages over income class.

b/ Blanks indicate no entries for category were listed by sample households.

c/ Includes vacation expenditures not broken down by category.

Source: Consumer expenditure questionnaires obtained for a sample of 63 Napa County households.

TABLE 35

Detailed Information on Consumer Expenditures for a Sample of Households
Napa County: Expenditures as Fraction of Income

Category	Income range within income class			
	$5,000-$7,999	$8,000-$10,999	$11,000-$24,999	$25,000 and over
Number of respondents	12	25	22	4
Average income in class (dollars)	6,597	9,396	14,805	53,303
Allocation of income--fraction of total				
Savings	.0486	.0556	.0658	.2017
Federal tax	.0920	.0941	.1418	.2720
State tax	.0039	.0057	.0156	.0441
City and county tax	.0385	.0358	.0341	.0267
Consumption expenditures				
Napa County	.7480	.7155	.6321	.3597
Bay area	.0405	.0540	.0611	.0708
Elsewhere	.0285	.0393	.0495	.0250
Napa County consumption				
Food	.1940	.2057	.1593	.0581
Clothing	.0613	.0474	.0356	.0295
Furniture	.0325	.0403	.0339	.0176
Insurance	.0413	.0323	.0486	.0445
House repairs	.0192	.0267	.0197	.0567
Laundering and cleaning	.0162	.0102	.0114	.0115
Rent	.1258	.1287	.0999	.0428
Legal and medical	.0500	.0323	.0311	.0102
Gasoline and oil	.0479	.0425	.0314	.0109
Auto maintenance	.0202	.0140	.0220	.0039
Utilities	.0409	.0373	.0286	.0053
Recreation	.0190	.0265	.0408	.0143
Automobile purchase	.0595	.0331	.0335	.0000[a]
Other	.0202	.0385	.0461	.0544
Bay area consumption				
Food	.0122	.0096	.0058	.0000
Clothing	.0088	.0096	.0126	.0127
Furniture[b]	.0063	.0110	.0049	.0082
All other[b]	.0132	.0238	.0378	.0499
Consumption elsewhere				
Food	.0003	.0042	.0036	.0023
Clothing	.0001	.0001	.0022	.0000
Furniture[b]	.0000	.0009	.0000	.0000
All other[b]	.0281	.0341	.0437	.0227

(Continued on next page.)

TABLE 35--continued.

a/ .0000 occurs because no entries for category were listed by sample households.

b/ Includes vacation expenditures not broken down by category.

Source: Consumer expenditure questionnaires obtained for a sample of 63 Napa County households.

CONSTRUCTION OF INPUT-OUTPUT TABLES FOR THE NAPA COUNTY ECONOMY

Introduction: Input-Output Models

A major goal of this study was the development of input-output tables for the Napa County economy. The tables were developed with 1965 as the base year. They were then applied in a series of forecasts tracing through the impacts of specific sources of change and growth for Napa County. The construction of the tables is described in this section; the applications are carried out in the following and final section of this report.

The tables in themselves are a research product that should be of future use. They can be used in other forecasts for Napa County, employing alternative formulations of sources of change in the County's economy. And the procedures employed in the tables' construction should be of help to input-output analysts concerned with similar studies for comparable regions.

In input-output analysis, three basic tables are constructed. These are (1) a flow table or matrix exhibiting the flows of purchases and sales among the industries or sectors of an economy, (2) a technical coefficient matrix in effect exhibiting the cost structure of each industry, and (3) an interdependence coefficient matrix which in effect shows the impact on all the industries of the economy flowing from a $1.00 expansion in sales of each industry in turn.

In reading the flow table, a given row exhibits the sales of a particular industry with column entries indicating which industry made those purchases. Thus, row 1 exhibits the sales of industry 1; the element in row 1, column 3, represents sales to industry 3 by industry 1; and the element in row 1, column 5, represents sales to industry 5 by industry 1. Similar relationships hold for each industry and its corresponding row.

For a given column, the elements can be viewed as purchases by a particular industry. Thus, for column 2 the flow table exhibits flows into industry 2 from each sector of the economy. The division of each of these elements, in turn, by the output of the given sector (in this case, industry 2) yields the technical coefficient matrix. If total costs equal total output (and generally they do for profits are usually included in the payments to households), the columns of the technical coefficient matrix can be viewed as exhibiting an industry's cost structure. Each element is the fraction of total costs (and total sales) paid out to the corresponding supplier. Thus, for column 3, row 6, the entry shows the fraction of its total sales paid by industry 3 to industry 6 for inputs furnished to industry 3 by industry 6.

In input-output work, certain industries are viewed as exogenous or external to the system. The exogenous sectors' purchases from the endogenous or internal sectors is termed "final demand." This is viewed as "causative" in the system. If final demand increases by a specific amount, the industry furnishing that increase, of course, expands production. As a consequence, that industry increases its use of inputs so that its suppliers will increase production. Then the suppliers, in turn, will increase their use of inputs so that their suppliers must expand, and so on ad infinitum. By the use of matrix algebra, the interdependence coefficient matrix is obtained from the technical coefficient matrix, and it exhibits the resultant of the expansion discussed above. A given column--say column 1--can be interpreted as follows: Say final demand on industry 1 has increased by $1.00. Then the entries in column 1 show the increased production (for each industry) ultimately induced by this expansion. The entry in column 1, row 5, shows the final impact on production of industry 5 after an infinite series of rounds of expansion has occurred in

response to the initial increase of $1.00 of final demand.[1/] The sum of the column 1 entries shows the total expansion--or multiplier effect--generated by the dollar increase in final demand on industry 1.

In terms of matrix algebra, this discussion can be formulated as follows: Let x_{ij} be the flow from industry i to industry j and let X_i be the output of industry i. Then,

- -

1/ The literature on input-output analysis is voluminous. Some useful references are:

Walter Isard in association with David F. Bramhall et al., Methods of Regional Analysis: An Introduction to Regional Science ("Regional Science Studies Series 4," Vol. II; Cambridge, Massachusetts: The MIT Press, 1960), Chap. 8, pp. 309-374.

Wassily W. Leontief, The Structure of American Economy, 1919-1939: An Empirical Application of Equilibrium Analysis (2d ed.; New York: Oxford University Press, 1951), 264p.

Morris R. Goldman, Martin L. Marimont, and Beatrice N. Vaccara, "The Interindustry Structure of the United States: A Report on the 1958 Input-Output Study," U. S. Office of Business Economics, Survey of Current Business, Vol. 44, No. 11 (November, 1964), pp. 10-32.

Vera Riley and Robert Loring Allen, Interindustry Economics Studies: A Comprehensive Bibliography on International Research ("Bibliographic Reference Series No. 4," Vol. II; Baltimore, Maryland: The Johns Hopkins Press, 1955), 280p.

United Nations, Statistical Office, Input-Output Bibliography, 1955-1960 (ST/STAT/7) (New York, 1961), 222p.

Idem, Input-Output Bibliography, 1960-1963 (ST/STAT/SER.M/39) (New York, 1964), 159p.

William E. Martin and Harold O. Carter, A California Interindustry Analysis Emphasizing Agriculture. Part I: The Input-Output Models and Results and Part II: Statistical Supplement, University of California, Giannini Foundation Research Report No. 250 (Berkeley, 1962), 79p and 121p., respectively.

Ananda S. Rao and David J. Allee, An Application of Interindustry Analysis to San Benito County, California, University of California, Giannini Foundation Research Report No. 278 (Berkeley, 1964), 108p.

Pinhas Zusman and Irving Hoch, Resource and Capital Requirement Matrices for the California Economy, University of California, Giannini Foundation Research Report No. 284 (Berkeley, 1965), 89p.

$$\{x_{ij}\}\ v \equiv X;\ i, j = 1, \ldots, n$$

where

v = a column vector with elements all equal to one

$\{x_{ij}\}$ = the flow matrix

and

X = the vector of X_i.

An element of the technical coefficient matrix is formed by writing $x_{ij}/x_j \equiv a_{ij}$, with $\{a_{ij}\} \equiv A$, the technical coefficient matrix for all sectors. If the first m sectors are endogenous, with x^*_{ij} denoting the flow between endogenous sectors, the following may be written:

$$\{x^*_{ij}\}\ v^* + \{Y_i\} = X^*$$

where

Y_i = final demand on sector i

v^* = a vector of ones of size mx1

X^* = the vector of endogenous outputs, X^*_i

and

$i, j = 1, \ldots, m$, where m is the number of endogenous sectors with $m < n$.

The technical coefficient matrix for endogenous sectors may be written A^* and is defined as the endogenous submatrix of A. Then, the following identity is obtained: $A^* X^* + Y = X^*$ where Y is the final demand vector. It follows that $Y = (I - A^*) X^*$ so that $X^* = (I - A^*)^{-1} Y$. The matrix $(I - A^*)^{-1}$ is the interdependence coefficient matrix. The final equation can be used in forecasting output under the assumption that the interdependence coefficient matrix is stable over time. A given final demand vector, Y, then yields a corresponding set of outputs, X^*. Hence, forecasts of Y yield corresponding forecasts of X^*.

In the present study, tables were constructed using 1965 as the base year. For forecasting purposes, it must be assumed that technical coefficients are stable over time; in this case, then, it is assumed that the 1965 cost structure will hold in the future.

In the present study, the following row sectors were specified:

1. Crop agriculture.
2. Livestock agriculture.
3. Wineries.
4. Manufactures--large.
5. Manufactures--medium.
6. Manufactures--small.
7. Wholesale and retail trade.
8. Services.
9. Construction.
10. Finance, insurance, real estate, and rentals.
11. Transportation, communication, and utilities.
12. Local government.
13. Households.
14. Imports, federal and state government taxes, and net saving.

Column sectors consisted of the first 13 sectors above plus exports to the Bay area, exports to the rest of the world,[1/] sales to tourists, and sales to federal and state governments.

In the following discussion, the first 11 sectors will sometimes be subsumed under the general heading of "business sectors."

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1/ Net investment (other than construction) is implicit in this sector.

In specifying the endogenous-exogenous breakdown, three alternative models were formulated. In the first model, the first 11 sectors (or business sectors) were treated as endogenous; thus, local government and households were treated as exogenous. In the second model, local government was treated as endogenous, so there were 12 endogenous sectors. In the third model, both local government and households were treated as endogenous, so there were 13 endogenous sectors.

These alternative formulations are applicable under differing circumstances. Thus, the 11-sector case is useful if forecasts of local government and household spending are given. This would hold, in particular, if population forecasts are given. The given household and local government spending forecast, in conjunction with a forecast of exports (including money flows to tourists and nonlocal government), could be used to forecast sales by the 11 endogenous sectors.

A variant would be to include local government as endogenous. The impact of changes in final demand on local government tax collections (corresponding to sales) could then be traced.

In both of the above models, changes in the composition of household spending (by sector and by location) are one of the determinants of endogenous output.

In the last model, households are endogenous. In this version, the input-output model can be employed to predict population. For example, this model is applicable to the question: What is the impact of a new industry locating in Napa County? The new industry presumably will induce new employment which, in turn, will lead to increased employment by supplying industries, etc. The ultimate impact in terms of increased household income can be found from this model. Given as estimate of income per capita, a corresponding estimate of increased population can be obtained.

A detailed discussion of forecast results using these alternative models appears in the concluding section of this report. The remainder of the present section is devoted to a description of procedures employed in constructing the flow table and the technical coefficient matrix for the Napa County economy and to a presentation of those tables. (The interdependence coefficient matrix is presented in the following section.)

Construction of the Flow Table: An Outline of the Steps Involved

In constructing the flow table, the following steps were carried out:

1. Information on the percentage distribution of sales by sector was developed for the agricultural sectors, wineries, the manufacturing sectors, wholesale and retail trade, and part of the services sector. Basic data employed here were obtained from survey questionnaires and interviews.

2. For the sectors above, total sales times percentages yields the row entries for the flow table. Hence, total sales were estimated by sector and the multiplications carried out.

3. For the remainder of services; for transportation, communication, and utilities; and for finance, insurance, real estate, and rentals, other input-output study results were utilized in developing flows.

4. For local government, data on the incidence of local government taxes were secured from published sources and from interviews with local government officials.

5. Information on payments to households was secured from a variety of sources. Purchases by households were developed as part of the work of steps 1 through 4; this was modified, however, on the basis of the survey of consumer expenditures carried out in the present study.

6. Imports and payments to nonlocal government were obtained as residuals by subtracting internal purchases from total sales. In the case of households, however, estimates of imports and government payments were available from the consumer expenditure survey.

As a consequence, row and column totals could be compared and checked against the estimated total household income of $211.520 million developed above (Table 6). It turned out that initial totals were close to the control total of $211.520 million, differing by rather small margins for both row and column, with one total above the control total and the other below it. Reconciliation and adjustment procedures were then developed to force a balance. Details for each step in this process will be presented at this point. Because these details can be tedious for readers not interested in the more technical aspects of input-output table construction, such readers might skim the remainder of this section--perhaps devoting some attention to preliminary stages of the construction presented in tabular form and then focusing on the outcome of the work (the flow matrix in Table 44 and the technical coefficient matrix in Table 46).

Detailed Procedure for the Percentage Distribution of Sales

Basic information on the distribution of sales was obtained from questionnaires mailed to 300 farms and 500 commercial and industrial firms. The response rate was 20 percent and 10.5 percent, respectively, for these mailings (the response rate for the consumer expenditure questionnaire was 16.8 percent for a mailing of 500 questionnaires). The questionnaires obtained from the business firms were supplemented by direct interviews carried out with a number of Napa County business officials. Information was usually secured on the percentage breakdown of sales by industry or sector of destination. Information on total sales was often withheld as being of a confidential nature, and information

on costs was generally not given because the development of such information was seen as too difficult. As a consequence, the flow table had to be developed on the basis of the readily available information on the percentage distribution of sales. It appears this situation is often the case in regional input-output studies.[1/]

There was a partial exception here in that cost data had been developed for wineries as summarized in Table 22 above. This information was used in developing the flows into the winery sector.

The final total of questionnaires and interviews employed was distributed as follows:

Crop agriculture	51
Livestock agriculture	9
Wineries	15
Manufactures--large	4
Manufactures--medium	7
Manufactures--small	21
Wholesale and retail trade	92
Services	47
Construction	6
Finance, insurance, real estate, and rentals	10
Transportation, communication, and utilities	2
Households	63

(For households, 84 replies were received, with 63 deemed usable.) In addition, there were a number of interviews with government officials. In developing the

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1/ Richard S. Peterson and Charles M. Tiebout, "Measuring the Impact of Regional Defense-Space Expenditures," Review of Economics and Statistics, Vol. XLVI, No. 4 (November, 1964), p. 421. Peterson and Tiebout followed the same procedures for the same reasons.

percentage distribution of sales by sector, the following procedures were employed for the individual sectors.

Agricultural Sectors

A crop sector and a livestock sector were defined. For each sector, the percentage distribution of sales obtained from each producer in the sample was weighted by the producer's sales, yielding a distribution of total sales in terms of purchasing sectors. These values were divided by the grand total to obtain an estimated percentage distribution for the sector.

Wineries

The distribution of sales by the wineries was obtained on the basis of questionnaires and interviews. Individual firm percentages were weighted by estimated firm sales and then overall percentages were derived. In addition, column entries for wineries were obtained from Table 22 above in the case of grape purchases and wages. These values were accepted over rival estimates as likely to be more accurate. Other data in Table 22 were used as a check on other column entries as finally developed.

Manufactures

The decision to define three manufacturing sectors was made after initial survey data were investigated. It appeared that exports were related to size of firm, so that the larger the firm size the greater the fraction of sales exported--that is, sold outside the County. [On the other hand, no definite pattern appeared when firms were grouped according to the Standard Industrial Classification (SIC).] Because export characteristics were expected to be of great significance in input-output work, the cataloguing into small, medium, and large firms was carried out. Firms with employment of 10 or less were classified as small; firms with employment between 11 and 30 were classified

as medium; and firms with employment above 30 were classified as large. Local newspapers were an exception to this rule; they were included in the small manufactures class because their sales are primarily local. (In a sense then, it might be better to label the manufacturing sectors as export-oriented, intermediate, and local. However, this involved the inference of the pattern between size and exports; it seemed less presumptive to retain the source of the classification in terms of size.)

For each class of manufactures, the percent distribution of sales for individual firms was obtained. These were weighted by employment, which was available for the firms in the sample. (This procedure could be checked against weighting by receipts in the case of large manufactures. Very similar results were obtained.)

Wholesale and Retail Trade

Initially, information was obtained on 11 categories of retail trade and on wholesale trade, with a percentage distribution of sales for each category in terms of row entries.[1/] Because column information could be obtained only in aggregate form, the rows were then aggregated as well, so that only one sector (wholesale and retail trade) was used in the final version of the flow table.

Percentage distributions of sales were secured for each firm in the sample. The dollar total of sales was often missing; however, it appeared that within

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1/ The categories were (1) lumber-building materials, hardware, and farm equipment; (2) general merchandise; (3) food stores; (4) automotive dealers; (5) gasoline service stations; (6) apparel and accessory stores; (7) furniture, home furnishings, and equipment stores; (8) eating and drinking places; (9) drug stores and proprietary stores; (10) other retail stores--for example, liquor stores, stationery stores, antique stores, jewelry stores, etc.; and (11) nonstore retailers (primarily vending machines).

a given city, the pattern of sales by establishment type was fairly uniform. Hence, firms in a given city within a particular establishment type were assigned equal weights. The percentages established for Napa and St. Helena were then weighted by the corresponding dollar sales figure given in the 1963 Census of Business.[1/] Calistoga was assumed to have half the amount of dollar sales of St. Helena on the basis of relative population size (Table 3). The small percentage of establishments located in the remainder of the County were assumed to have the same distribution as the weighted average of Napa, St. Helena, and Calistoga.

Selected Services

The service sector includes selected services, professional services and nonprofit organizations, and private educational services. The distribution of sales percentages was developed for the first of these, broken down into seven components. Initially, a row was set up for each component with a single aggregated column for selective services as a group.

Procedures followed here were similar to those used for wholesale and retail trade. Again, receipts by individual firms were usually not available, so each firm was weighted equally. Average percentages by city were developed, and these were weighted by the number of establishments located in the city as given in the 1963 Census of Business.[2/] Establishments outside the cities were assumed to have the same distribution as the weighted average of the cities. Then the seven subcategories of selected services were aggregated by weighting

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1/ U. S. Bureau of the Census, Census of Business, 1963. Vol. 2 . . ., pp. 6-12 and 6-13.

2/ Ibid., p. 6-10.

each subcategory by its county receipts estimated from data in the 1963 Census of Business.[1/]

Construction

The percentage distribution of sales was based on survey data. The percentage distribution of each firm was weighted by its employment, and a weighted average was derived thereby.

Results to this point are summarized in Table 36, which exhibits the percentage distribution of sales by sector. (Sales to households and local government, at this point, are shown in aggregated form; disaggregation was carried out as a later step.)

Flows for Other Business Sectors

The percentage distribution of sales procedure discussed above was not employed for (1) professional services, nonprofit organizations, and private educational services; (2) transportation, communications, and utilities; and (3) finance, insurance, real estate, and rentals. For these sectors, survey information was generally quite limited; hence, primary reliance was placed on other input-output tables assumed applicable to the Napa economy. In particular, the 1958 Interindustry Transactions Table for the United States[2/] and

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1/ Ibid., p. 6-49. The seven subcategories are (1) hotels, motels, and camps; (2) personal services; (3) miscellaneous business services; (4) automobile repair services; (5) miscellaneous repair services; (6) motion picture theaters; and (7) amusement and recreation services, except motion pictures.

2/ U. S. Office of Business Economics, Survey of Current Business, Vol. 45, No. 9 (September, 1965), pp. 33-39.

TABLE 36

Percentage Distribution of Sales by Sector

Sector	Crop agri-culture	Livestock agri-culture	Wineries	Manufactures			Whole-sale and retail trade	Selected services	Construc-tion	Finance, insurance, real estate, and rentals	Transpor-tation, communi-cation, and utilities	Households (and local government)	Bay area	Rest of the world	Tourists	Federal and state government
				Large	Medium	Small										
Crop agriculture		.005166	.430504				.208979					.048216	.266790	.040345		
Livestock agriculture						.003516						.006892	.973558	.016034		
Wineries			.011400				.006080					.002833	.287895	.629818	.054512	.007462
Manufactures																
Large				.013881			.000758		.033924			.004183	.323368	.623886		
Medium	.124189		.006899	.007865			.006899		.095212			.023735	.529323	.205878		
Small			.083461			.016487	.302099	.040655	.022427	.005018		.313160	.045878	.170815		
Retail trade																
Lumber, hardware, and farm equipment	.021940		.002167				.020314		.312703			.620666	.020991	.001219		
General merchandise												.995775	.003170	.001055		
Food stores							.068976					.854761	.039642	.000891		.035730
Automotive dealers				.006857	.002182		.103072	.023152	.004052		.004452	.749199	.089671	.017363		
Gasoline service stations									.041627			.794812	.014030	.002326	.147205	
Apparel and accessories												.903043	.095553	.001404		
Furniture, home furnishings, and equipment							.000372	.000186	.000062			.868410	.123081	.007889		
Eating and drinking places												.920359	.006671	.001293	.071677	
Drug and proprietary stores												.978288	.011691	.010021		
Other retail stores		.011023	.002795			.002795	.048750	.035243	.013197	.013196		.795218	.076851	.000932		
Nonstore retailers												1.000000				
Wholesale trade							.773333						.226667			
Selected services																
Hotels, motels, and camps												.049371	.028815	.066248	.855566	
Personal services			.006257				.022819		.005521	.005521		.902834	.052264	.001840		.002944
Miscellaneous business services			.040000			.060000	.200000		.023750	.100000		.451250	.125000			
Automobile repairs							.080135		.052502	.026251		.774446	.006513	.000153	.060000	
Miscellaneous repairs						.009652	.008044		.094914			.853607	.033783			
Motion pictures												1.000000				
Amusement and recreation services												.288837			.711163	
Construction			.030943				.030942		.191701	.027477		.195664	.006024			.517249

Source: Based on survey data developed for this study. See text for details, pp. 101ff.

the Kalamazoo County Current Account Table, 1954,[1/] were used in developing Napa estimates.[2/]

Services Other than Selected Services

For professional services and nonprofit organizations, the United States distribution of sales (from the 1958 U. S. table) was used in developing flow percentages. In the U. S. table, 90 percent of these services are consumed by households and 10 percent are consumed by the remaining sectors. In applying this information, it was estimated that 10 percent of the flow to households was consumed by households residing outside the County. The 10 percent consumed by remaining sectors was distributed to these sectors on the basis of their sales.

Private educational services flow almost entirely to the household sector. Enrollment at Pacific College at Angwin includes a large number of out-of-county students; hence, 30 percent of the sales of this sector was treated as exports.

Transportation, Communication, and Utilities

Flows for this sector were generally estimated using technical coefficients from the input-output studies noted above. Thus, column entries (in terms of technical coefficients) were obtained; these were then multiplied by estimated sales of the column sector.

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1/ The W. E. Upjohn Institute for Employment Research, The Kalamazoo County Economy as Reflected in the Kalamazoo County Current Accounts Table for 1954 (Kalamazoo, Michigan, 1960), pp. 92-95.

2/ Although Kalamazoo is in the eastern part of the country, its size makes it analogous to Napa. Kalamazoo County's population was 169,172 in 1960; see U. S. Bureau of the Census, County and City Data Book, 1962 (A Statistical Abstract Supplement), 1962, p. 172. This compares to a 1965 Napa County population of around 76,000. The Kalamazoo coefficients were used only for categories (2) and (3) above. The size analogy seems acceptable for these categories.

For the agricultural sectors, the U. S. table coefficients were used. For manufactures, the technical coefficients for subcategories were obtained from the U. S. table, and then these were weighted by Napa County employment. For wholesale and retail trade, services and construction averages of the United States and the Kalamazoo coefficients were developed. Sales of this sector to itself and to finance, insurance, real estate, and rentals were handled by using the Kalamazoo coefficients. Sales to households were based on the Bureau of Labor Statistics data on western United States household expenditures in this sector. The estimated percent of personal income allocated here was 2.9 percent.[1/]

Finance, Insurance, Real Estate, and Rentals

The same sources and procedures used for transportation, communication, and utilities were applied in estimating technical coefficients for finance, insurance, real estate, and rentals. There was one exception in that rentals of the households sector were estimated from the survey of consumer expenditures. The percent of household income allocated to rents turned out to be 11 percent.

Sales by the Business Sectors

Sales by sector for 1965 were estimated for those sectors for which percentage sales data had been developed. Combining the two sets of figures yielded money flows for the corresponding rows. In addition, these sales figures, when multiplied by the respective column technical coefficients,

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1/ U. S. Bureau of Labor Statistics, Consumer Expenditures and Income; Detail of Expenditures and Income; Total Western Region, Urban and Rural, 1960-61, Supplement 3-Part A to BLS Report 237-92, 1966, pp. 2-15.

yielded the flows for sectors for which percentage sales data had not been developed. The sum of these flows, by row, yielded total receipts for the sectors in this group. Results appear as Table 37. (In addition, Table 37 contains estimates of employment by sector for 1965.) Details on estimation of receipts by sector follow at this point.

Agricultural Sectors

Sales for both crop and livestock sectors were obtained from the Napa County Agricultural Commissioner's Annual Report for 1965.

Wineries

Winery sales were estimated on the basis of questionnaire and interview information developed in this study. The 1965 figure is reported in Table 16 above.

Manufactures

There were four firms in the large manufactures classification. Data on sales of these firms were secured by interview and aggregated. Dollar values of sales generally were not secured from the medium and small manufacturing firms. These figures were estimated as follows: The 1963 value of shipments per employee for each SIC industry was obtained for United States data.[1/] These figures were adjusted to 1965 levels, using the ratio of 1965-1963 industrial production indexes, accounting for changes in output per worker in that period.[2/] As a further adjustment, the figures were multiplied by the

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TABLE 37

Estimated Sales and Employment of Business Sectors
Napa County, 1965

Sector	Total sales	Total employment
	1,000 dollars	
Crop agriculture	8,130	1,974[a/]
Livestock agriculture	14,220	
Wineries	14,474	434
Manufactures--large	71,247	1,879
medium	7,247	219
small	9,765	396
Wholesale and retail trade	137,289	4,039[b/]
Services	32,169[c/]	3,317[b/ c/]
Construction	21,305	800
Finance, insurance, real estate, and rentals	40,019	483
Transportation, communication, and utilities	19,558	1,045

(Continued on next page.)

TABLE 37--continued.

a/ Includes 1,158 farm operators and unpaid family workers and 816 hired laborers.

b/ Includes active proprietors.

c/ By subsector, sales and employments were:

	Sales	Employees	Self-employed and proprietors
Selected services	9,147	710	423
Professional services and nonprofit organizations	14,572	1,181	182
Private educational services	8,450	821	0

Source: Major sources for this table are specified in the discussion in text. In addition, employment for crop and livestock agriculture was obtained from California Department of Employment, "California Employment by Type of Worker--Napa County, Mid-month Estimates, 1955-1960," Report 881M, No. 4 (Sacramento, December, 1965), numerous paging.

wholesale price index for 1965 on a 1963 base, accounting for price level changes between 1963 and 1965.[1/]

Finally, shipments per worker were multiplied by number of workers for each Napa industry. These were then aggregated over the medium and small categories, respectively.

Wholesale and Retail Trade

The ratio of sales to wages was computed from data in the 1963 Census of Business.[2/] This ratio was 9.7 for Napa County. It was assumed that this ratio held for 1965. Total wages for 1965 were estimated as $14.15 million from data in California Employment and Payrolls.[3/] This implied 1965 sales of $137.3 million.

Selected Services

As in the case of retail and wholesale trade, it was assumed that the ratio of sales to wages was stable (at least in the short run) for selected services. This ratio for 1963 appeared as 3.62 in the Census of Business;[4/] multiplying this by estimated wages for 1965 yielded a sales figure of approximately $9.1 million.[5/]

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1/ Ibid., pp. 352 and 353.

2/ Idem, Census of Business, 1963. Vol. 2 . . ., pp. 6-12 and 6-13.

3/ California Department of Employment, California Employment and Payrolls, Report 127, No. 28a, January-March, 1965 (Sacramento, 1966), 22p.

Ibid., Report 127, No. 28b, April-June, 1965 (Sacramento, 1966), 82p.

Ibid., Report 127, No. 28c, July-September, 1965 (Sacramento, 1966), 87p.

4/ U. S. Bureau of the Census, Census of Business, 1963. Selected Services, California, BC63-SA6, 1965, p. 6-49.

5/ California Department of Employment, California Employment and Payrolls, Report 127, No. 28d, October-December, 1965 (Sacramento, 1966), pp. 17 and 18.

Professional Services and Nonprofit Organizations

This group of services includes (1) medical and other health services, except government-run hospitals; (2) legal services; (3) nonprofit membership organizations; and (4) miscellaneous services--engineering, accounting, etc. The number of paid employees in this group of services was estimated by subtracting the number of employees in selected services (710) from the combined total of selected services and this group of services (1,891) which yielded a figure of 1,181.[1/] The number of self-employed persons in this group was obtained from the 1965 Napa County Telephone Directory, "Classified Section," and totaled 182 (this included 71 physicians, 39 dentists, 17 accountants, 33 attorneys, 11 architects, and 11 engineers).

Average wages for employed persons in this group was estimated as $5,612 for the state in 1965.[2/] Napa's average wages were 0.8 of the state figure in 1964 so that the 1965 Napa figure could be set at 0.8 of $5,612 or $4,490.[3/] This implied total wages of $5.3 million (via multiplying number of employees by average wages). For the self-employed group, average income was estimated on the basis of the consumer expenditure survey. Estimated total income came to $3.4 million. Hence, total wages and self-employment income was roughly $8.7 million.

The 1958 United States interindustry transactions table shows that labor costs and profits for this sector equal 0.68 of total sales.[4/] Assuming that

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1/ These employment data appeared in ibid., Report 127, No. 28a; Report 127, No. 28b; and Report 127, No. 28c.

2/ Ibid., Report 127, No. 28d, p. 19.

3/ Ibid., Report 127, No. 27d, October-December, 1964 (Sacramento, 1965), pp. 17-19 and 40.

4/ U. S. Office of Business Economics, Survey of Current Business, Vol. 45, No. 9 (September, 1965), pp. 34-39.

0.08 of sales equals the profit margin, sales could be estimated by dividing labor costs (estimated above) by 0.6; this gave a sales estimate of roughly $14.6 million

Private Educational Services

In the 1960 Census of Population, 718 persons are listed as employed in private educational services in Napa County.[1/] This figure was adjusted to 1965 levels by assuming it increased by the same percentage as population (14.4 percent), yielding a 1965 estimate of 821.

Data on Napa school employment in the Census of Government indicated this was distributed as 82 percent teachers and 18 percent other employees.[2/] The 821 figure above was then distributed using these percentages to obtain an estimate of 673 teachers and 148 other employees.

The 1965 average salary of teachers was estimated as $7,950;[3/] this was assumed applicable to the 673 teachers in private schools. The average 1965 wage for nonteaching persons in educational services was $3,815 for the state of California;[4/] this was assumed applicable to the 148 other employees.

The resultant estimate of wages and salaries was $5.9 million. Published data on expenditures on public schools indicate that approximately 77 percent

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1/ U. S. Bureau of the Census, U. S. Census of Population: 1960. Vol I . . ., p. 6-429.

2/ Idem, Census of Governments: 1962. Vol. VII, No. 5, Governments in California, 1964, p. 58.

3/ Based on data in California Department of Education, Salaries of Certified Employees in California Public Schools (Sacramento, 1964), pp. 4 and 5, and James M. Campbell, Economic Survey--Napa County, Master Plan Project, Part I (Napa, California, 1960), p. 38.

4/ California Department of Employment, California Employment and Payrolls, Report 127, No. 28d.

of total expenditures was spent for wages and salaries.[1/] It was assumed that this relation also held for private schools in 1965. Total sales of $8.45 million in 1965 was the final dollar estimate developed.

Construction

The construction firms included in the survey sample accounted for approximately 25 percent of the total construction employment in the County. On the basis of the survey data, the average value of construction per worker was estimated as $26,633. This figure was multiplied by the estimated total construction employment in the County, yielding estimated total sales for 1965 of approximately $21.3 million.

Local Government

Tax revenues and intergovernmental transfers to local government are the dollar flows in the local government row of the flow table, corresponding to sales of the business sectors. Expenditures by local government make up the entries in the local government column of the flow table.

Local government includes county government, city governments, and special district governments in Napa County. Input-output flows refer to the combined revenues and expenditures of all these governments.

Local Government Revenues

Local government revenues include county property taxes, property taxes levied by school districts, nonproperty taxes, city of Napa taxes,[2/] fines and

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1/ U. S. Bureau of the Census, Census of Governments: 1962. Vol. VII . . ., p. 73.

2/ Taxes of other cities are included in the County tax figures.

penalties, and licenses. In addition, there are transfer payments to local governments from the state and the federal governments.

The revenues collected locally were distributed by sector source and aggregated by sector. Components and totals appear in Table 38. Details on procedures follow.

An estimate of calendar year 1965 county property taxes was based on a 1964-65 fiscal year figure of $3,081,421,[1/] an estimate that fiscal year 1965-66 was 18 percent above the previous fiscal year,[2/] and an averaging of these figures to yield $3.359 million which is 9 percent above the 1964-65 fiscal year figure.

The following estimate of the percentage distribution of property taxes by source was obtained from the Napa County Assessor's Office by personal interview:

	Percent
Households	50
Agriculture	30
Manufactures (including wineries)	10
Other business sectors (sectors 7 through 11)	10

The property taxes from agriculture were estimated to be distributed as three-fourths crop agriculture and one-fourth livestock agriculture on the basis of available evidence. The property taxes from manufacturing were distributed in proportion to sales. Of those from other business sectors,

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1/ California Controller, Annual Report of Financial Transactions Concerning Counties of California; Fiscal Year 1964-65 (Sacramento, 1966), p. 2.

2/ Idem, Annual Report of Assessed Valuation, Tax Rates and Indebtedness of the Counties of California for the Fiscal Year 1964-65 (Sacramento, 1964), p. 15, and Annual Report of Assessed Valuation, Tax Rates and Indebtedness of the Counties of California for Fiscal Year 1965-66 (Sacramento, 1965), p. 15.

TABLE 38

Local Government Revenue (Other than Transfer Payments) by Sector Source of Revenue, Napa County, 1965

Sector	Total taxes to local government	Taxes				Fines and penalties	Licenses
		County property	School district property	Non-property	City of Napa		
	1,000 dollars						
Crop agriculture	1,382	755	610	a/			18
Livestock agriculture	484	251	203				31
Wineries	230	47	151				32
Manufactures--large	1,175	231	749		35		159
medium	123	24	76		7		16
small	175	34	109		10		22
Wholesale and retail trade	1,561	242	586	291	134		307
Services	387	60	147	73	34		72
Construction	92	11	27		6		48
Finance, insurance, real estate, and rentals	137	12	27		7		91
Transportation, communication, and utilities	88	11	27		6		44
Households	5,008	1,680	2,712		444	172	

(Continued on next page.)

TABLE 38--continued.

a/ Blanks indicate zero or negligible amount.

Sources:

California Controller, Annual Report of Financial Transactions Concerning Counties of California; Fiscal Year 1964-65 (Sacramento, 1966), p. 2.

Idem, Annual Report of Assessed Valuation, Tax Rates and Indebtedness of the Counties of California for the Fiscal Year 1964-65 (Sacramento, 1964), p. 15; and Annual Report of Assessed Valuation, Tax Rates and Indebtedness of the Counties of California for Fiscal Year 1965-66 (Sacramento, 1965), p. 15.

Interview with officials in City of Napa Auditor's Office.

90 percent was allotted to trade and to services on the basis of their sales, and the remaining 10 percent was distribtued equally among the remaining sectors.

Property taxes by school districts were listed as $4.976 million for fiscal 1964-65 in the Napa County budget for that year. Calendar year 1965 was estimated (using the 9 percent adjustment developed earlier) as being equal to $5.424 million. The distribution of these taxes by sector was assumed the same as the County property tax distribution, save that the agricultural share was reduced from 30 percent to 20 percent and manufacturing and other business sectors were each increased by 5 percent.

Nonproperty taxes for the County amounted to $364,000.[1/] These were distributed between trade and services on the basis of their sales. On the basis of information obtained from the City of Napa Auditor's Office, total City of Napa taxes of $683,000 in 1965 were allocated by sector. Fines and penalties amounting to $172,000 were allocated entirely to households. Licenses, use of property, etc., amounted to $841,000 and were allocated to the business sectors on the basis of their sales. Federal and state government transfer payments to Napa County local governments equaled 0.768 of revenue from all other sources in 1962.[2/] If the same fraction is applied to 1965, an estimate of $8.330 million is obtained. When this is added to all other revenue, a revenue total of $19.173 million is obtained. This is a bit above the estimated 1965 expenditures total of $19.025 million; but this sort of small difference also occurred in 1962, so the figure was accepted as reasonable.

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1/ Idem, Annual Report of Financial Transactions. . . .

2/ U. S. Bureau of the Census, Census of Governments: 1962. Vol. VII . . ., p. 322.

Local Government Expenditures

Expenditures by local government were estimated, and then the previously aggregated flows into a combined local government and household column were disaggregated. Results appear in Table 39. A description of procedures follows:

Data from the County budget was used to distribute County expenditures by sector. School district expenditures were estimated as follows: Data for 1962 showed that property taxes comprised 0.43 of general revenue in Napa County.[1/] Applying this fraction to 1965 yielded estimated revenue of $12.6 million. In addition, salaries and other expenditures were estimated by applying 1962 relations to 1965.

City of Napa expenditure information was obtained from the City Auditor's Office. The sum of County, school districts, and city of Napa data yielded total local government expenditures.

Households

A control total of $211.520 million was set up as the sought for sum of both the household row and household column. This amount equals the estimated 1965 household income developed above (Table 6).

The Household Row

The household row contains payments to households by the sectors of the economy--defined here in terms of wages and proprietor income, other labor income, rent, dividends, interest and profit, and transfer payments. Wage and proprietor incomes were estimated for each sector in turn.

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1/ Ibid., p. 73.

TABLE 39

Distribution of Expenditures by Local Governments and Sectors
Napa County, 1965

Sector	Expenditures			
	Total	Napa County	School districts	City of Napa
	1,000 dollars			
Retail trade	982	306[a/]	447[b/]	229
Services	2	2	0	
Construction	388	44[b/]	0	344
Finance, insurance, real estate, and rentals	308	187	0	121
Transportation, communication, and utilities	645	184	340	121
Households	16,279	7,174	7,770	1,335
Bay area and rest of world	569	328	223	18

a/ Half of estimated total purchases from retail trade under the assumption that 50 percent is local and 50 percent is imported.

b/ Two-thirds of estimated total assuming that a fraction was purchased from local firms.

Sources: State of California, County of Napa, Final Budgets for the Fiscal Year 1964-65 (Napa, California); U. S. Bureau of the Census, Census of Governments: 1962. Vol. VII, No. 5, Governments in California, 1964, pp. 73 and 322; and interview with officials, City Auditor's Office, City of Napa.

For the agricultural sectors, a U. S. Department of Agriculture input-output study was utilized.[1/] In this study, wages and salaries plus proprietors' income amounted to 0.420 of crop sales and 0.246 of livestock sales for the United States.[2/] It was assumed these fractions held for Napa as well.

Wages for wineries were estimated above (Table 21), and that estimate was used here. Wages for large manufactures were secured by questionnaires and interviews. Wages for medium and small manufactures were estimated from published data in California Employment and Payrolls.[3/]

The same source was used to estimate wages for wholesale and retail trade and for selected services. In both cases, imputed average proprietor income was set at 1.25 the average wage of employees. Wages for other services were estimated in connection with the development of estimates of receipts, and procedures are described above. California Employment and Payrolls data were again used to estimate wages for the remaining business sectors--construction; transportation, etc.; and finance, etc.

Wages paid by local government were part of the total payments to households listed in Table 39. Transfer payments from local governments to households were estimated from the County budget as equal to $4.256 million. The remaining $12.028 million payments to the household sector were estimated to consist of $11.488 million in wages and $535,000 in other labor income (primarily retirement benefits).

1/ Robert H. Masucci, Dollar Volume of Agriculture's Transactions with Industry, U. S. Department of Agriculture Marketing Research Report No. 375, 1959, pp. 8-13.

2/ Proprietors' income includes net rents received or imputed to landlords living on farms, following national income accounting practices. U. S. Office of Business Economics, National Income, 1954 Edition: A Supplement to the Survey of Current Business, 1954, p. 91.

3/ California Department of Employment, California Employment and Payrolls, Report 127, No. 28a; Report 127, No. 28b; and Report 127, No. 28c.

Payments from the household sector to itself covered the wages of private household workers. Total domestic employment was estimated as 715, based on the 1960 Census of Population data updated to 1965.[1/] The average 1965 wage of household workers in California of $4,350[2/] was multiplied by total employment to obtain a total wage bill of $3.110 million.

Wages paid to households from the federal and state governments and the Bay area were estimated at this point. (It was here assumed that wages received from the rest of the world were negligible).

As an initial step, the distribution of Napa personal income by factor share was updated to 1965, using California Chamber of Commerce and U. S. Department of Commerce data.[3/] Results appear in Table 40. The total of wages and proprietor income here is $149.968 million. (Other labor income of $6.346 million is not included in this total.)

Then the distribution of Napa residents' employment in terms of a cross-classification was developed. The cross-classification involved government-nongovernment versus within-outside the County employment. On the basis of the 1960 Census of Population data, it was known that 0.305 of the Napa work force was employed in government[4/] and that roughly 0.250 was employed outside

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1/ U. S. Bureau of the Census, U. S. Census of Population: 1960. Vol. I . . ., p. 6-429.

2/ California Department of Employment, California Employment and Payrolls, Report 127, No. 28d.

3/ California State Chamber of Commerce, Research Department, Economic Survey Series, "Personal Income of California Residents, By Major Components, By Counties--1960," No. 16 (Sacramento, 1963); and U. S. Department of Commerce, Survey of Current Business, Vol. 44, No. 7 (July, 1964), p. 10, and Vol. 46, No. 11 (November, 1966), p. 6.

4/ Unpublished U. S. Bureau of the Census data on computer tape for 1960 Census of Population; data obtained through Gary Elsner (formerly with the Giannini Foundation, University of California, Berkeley) from the Michigan State University Computer Laboratory.

TABLE 40

Estimated Distribution of Personal Income by Shares
Napa County, 1960 and 1965

Income share	Napa County 1960	United States values, 1965 relative to 1960	Napa County 1965 estimate	Napa County 1965 dollar estimate
	1	2	3	4
				1,000 dollars
Wages	.5931	.991	.587	124,163
Income				
Proprietor	.1355	.904	.122	25,805
Other labor	.0231	1.296	.030	6,346
Property	.1447	1.092	.158	33,420
Transfer	.1036	.980	.103	21,786
Total	1.0000		1.000	211,520

Sources:

Col. 1: California State Chamber of Commerce, Research Department, Economic Survey Series, "Personal Income of California Residents, By Major Components, By Counties--1960," No. 16 (Sacramento, 1963).

Col. 2: U. S. Office of Business Economics, Survey of Current Business, Vol. 44, No. 7 (July, 1964), p. 10, and Vol. 46, No. 11 (November, 1966), p. 6.

Col. 3: Column 1 times column 2.

Col. 4: Column 3 times estimated total income of $211.52 million. Table 6, supra, p. 17.

the County.[1/] (Some of those employed were in both government and outside County employment, and the problem at this point was to estimate this fraction to avoid double counting.)

Given these figures, a breakdown by category of employment was then developed using additional Census of Population information. Given the available data, gaps in the information could be filled by subtraction. The information developed is shown in Table 41.

On the basis of Table 41, the following fractional distribution was obtained on employment in 1960:

	Government	Nongovernment	Total
Within County	0.20	0.55	0.75
Outside County	0.11	0.14	0.25
Total	0.31	0.69	1.00

Assuming that the distribution of wages in 1965 corresponds to the employment distribution in 1960 yields the estimate that 20 percent of the total is obtained from government employment within the County and 25 percent of the total is obtained from employment outside the County (both government and nongovernment). The total of these percentages is 45 percent; hence, total wage and proprietor income times the corresponding fraction ($149.968 million times 0.45) yields $67.485 million. Total proprietor and wage income for the other sectors had been estimated as $81.447 million to this point. (This is the sum of wage estimates developed above for sectors 1 through 13.) The sum of the two subtotals is $148.932 million, quite close to the control total of $149.968 million. The former figure times 1.0153 equals the latter. This

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1/ U. S. Bureau of the Census, U. S. Census of Population: 1960. Vol. I . . ., pp. 6-409 to 6-141.

TABLE 41

Distribution of Employment--Cross-Classification
Public-Private Versus Within-Outside, Napa County, 1960

County employment	Employment		
	Government	Nongovernment	Total
	persons		
Within County			
Public administration	1,185	a/	
Public schools	850		
Napa State Hospital	1,250		
Veterans Home	600		
Other	361		
Subtotal	4,246	11,882	16,128
Outside County			
Mare Island	2,204		
Travis Air Force Base	100		
Subtotal	2,304	3,063	5,367
TOTAL	6,550	14,945	21,495

(Continued on next page.)

TABLE 41--continued.

a/ Blanks indicate no data available.

Sources:

Within County: For public administration and public schools, see U. S. Bureau of the Census, U. S. Census of Population: 1960. Vol. I, Characteristics of the Population, Part 6, California, 1963, Table 85, p. 6-429.

For Napa State Hospital and Veterans Home, see James M. Campbell, Economic Survey--Napa County, Master Plan Project, Part I (Napa, California, 1960), pp. 37 and 38; Farnum Kerr Associates and Frederick L. Hotes, Napa County Water Needs Study Plan (Napa, California, 1961), p. A-31; and San Francisco Chronicle, January 28, 1967, p. 3.

"Other" obtained as residual.

Subtotal for nongovernment and total (employment) obtained as residual.

Outside County: For Mare Island, see U. S. Bureau of the Census, op. cit. Data on persons employed in "transportation equipment except motor vehicles" assumed to be entirely Mare Island employment.

Travis Air Force Base, estimated.

Subtotal for nongovernment obtained as residual; for total (employment), see U. S. Bureau of the Census, op. cit., pp. 6-409 and 6-414.

TOTAL: For government, see unpublished U. S. Bureau of the Census data on computer tape for 1960 Census of Population; data obtained from Gary Elsner (formerly with the Giannini Foundation, University of California, Berkeley), from the Michigan State University Computer Laboratory.

Nongovernment obtained as residual.

For total (employment) within and outside County, see U. S. Bureau of the Census, op. cit., Table 85, p. 6-429.

scale value can be interpreted as accounting for differences in relative growth between 1960 and 1965 and differences in average wage rates between the broad groupings covered here. This scale value was then applied to force equality. As a consequence, government wage payments within the County were estimated as $30.450 million. Subtracting local government wages yielded $18.962 million as the estimate of the state and federal wage bill. Payments to persons employed outside the County were then estimated as $38.071 million.

Other labor income was estimated as totaling $6.346 million in Table 40. Other labor income consists of (1) employer contributions for health and welfare, pensions, and group insurance; (2) compensation for injuries; and (3) jury and witness fees, military reserve pay, marriage fees to justices of the peace, and compensation of prison inmates.[1/] The last category comprises 11 percent of the total and was treated as coming entirely from state and federal governments, with an estimate thereby of $698,000. This left $5.648 million of the original figure, which was allocated to other industries on the basis of their share of wages.

Property income to households is listed as $33.420 million in Table 40. United States data for 1965 indicates that this is distributed as 0.24 from rent, 0.25 from dividends, and 0.51 from interest.[2/] The 0.24 figure for rent yields a value of $8.021 million, which was treated as a flow from the finance, insurance, real estate, and rental sector to households.

The distribution of dividend and interest income by sector involved a fair amount of arbitrary judgment. Thus, on the basis of United States national

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1/ U. S. Office of Business Economics, National Income, 1954 Edition . . ., pp. 74 and 75.

2/ Idem, Survey of Current Business, Vol. 46, No. 11 (November, 1966), p. 6.

income data, it was decided that firms made factor payments which were distributed two-thirds to labor and one-third to capital. Hence, dividend and interest income was assumed to equal one-half of wages so that it would amount to one-third of the total.

Then a series of guesswork estimates were employed to decide what percent of dividend and interest payments went to Napa residents as opposed to payments going to persons outside the County. The local payment percentages assigned to Napa were as follows: (1) small manufactures, 100 percent; (2) medium manufactures, 60 percent; (3) large manufactures, 20 percent; (4) wineries, 90 percent; (5) wholesale and retail trade, 50 percent; (6) construction, 50 percent; and (7) transportation and utilities, 10 percent. It was assumed that services made no dividend and interest payments and that roughly 10 percent of the total $25.399 million figure was paid directly from the federal and state governments, Bay area, and rest of the world to households (with respective amounts of $250,000; $500,000; and $1.750 million). The total of payments to this point was subtracted from the overall total; and the difference was allocated to finance, insurance, real estate, and rentals on the argument that a relatively large proportion of payments would move through this sector.

Finally, total transfer payments of $21.786 million were broken into the amount paid by local government, as previously estimated, and the residual amount of $17.530 million from state and federal governments.

The results discussed above are summarized in Table 42, which lists flows into the household sector by sector and type of income.

The Household Column

The household column contains purchases by households from the sectors of the Napa economy, purchases from outside the Napa economy (imports from the Bay area and the rest of the world), and taxes paid to government.

TABLE 42

Flows into the Household Sector (Row Entries) by Sector and Type of Income, Napa County

Sector	Row flows					
	Total	Wages and proprietor income	Other labor income	Rent	Dividends and interest	Transfers
	1,000 dollars					
Crop agriculture	3,455	3,455	a/			
Livestock agriculture	3,498	3,498				
Wineries	4,012	2,681	125		1,206	
Manufactures--large	13,700	11,949	557		1,194	
medium	1,885	1,400	65		420	
small	3,916	2,532	118		1,266	
Wholesale and retail trade	24,889	18,483	861		5,545	
Services	20,091	19,196	895			
Construction	7,549	5,823	271		1,455	
Finance, insurance, real estate, and rentals	21,993	2,393	112	8,021	11,467	
Transportation, communication, and utilities	7,596	6,927	323		346	
Local government	16,279	11,488	535			4,256

(Continued on next page.)

TABLE 42--continued.

Sector	Row flows					
	Total	Wages and proprietor income	Other labor income	Rent	Dividends and interest	Transfers
	1,000 dollars					
Households	3,110	3,110				
Bay area	40,357	38,071	1,786		500	
Rest of world	1,750	0			1,750	
Federal and state government	37,440	18,962	698		250	17,530
Total	211,520	149,968	6,346	8,021	25,399	21,786

a/ Blanks indicate not applicable.

Sources:

Tables 39, 40, and 41, supra, pp. 122, 125, and 127, respectively.

Robert H. Masucci, Dollar Volume of Agriculture's Transactions with Industry, U. S. Department of Agriculture Marketing Research Report No. 375, 1959, pp. 8-13.

California Department of Employment, California Employment and Payrolls, Report 127, No. 28a; Report 127, No. 28b; Report 127, No. 28c; and Report 127, No. 28d.

U. S. Bureau of the Census, U. S. Census of Population: 1960. Vol. 1, Characteristics of the Population, Part 6, California, 1963, p. 6-429.

California State Chamber of Commerce, Research Department, Economic Survey Series, "Personal Income of California Residents, By Major Components, By Counties--1960," No. 16 (Sacramento, 1963); and U. S. Department of Commerce, Survey of Current Business, Vol. 44, No. 7 (July, 1964), p. 10, and Vol. 46, No. 11 (November, 1966), p. 6.

Unpublished U. S. Bureau of the Census data on computer tape for 1960 Census of Population; data obtained through Gary Elsner (formerly with the Giannini Foundation, University of California, Berkeley) from the Michigan State University Computer Laboratory.

Estimated purchases from the business sectors, local government, and households emerged from the development of the row flows discussed above.

In addition, however, an amount equal to 11 percent of income was attributed to total payment for housing, based on the consumer expenditures survey. This amount was allocated as follows: $4.536 million was estimated as property taxes, comprising the bulk of household payments to local government, and $18.731 million was treated as net rental payment (net of taxes) and treated as a flow into the combined finance, insurance, real estate, and rentals sector.[1/] This figure includes the imputed rental value of housing owned by consumers. The total flow into real estate, etc., includes an additional $8.461 million for finance, insurance, and real estate as well as the estimated amount for rentals.

Napa household flows into final demand sectors were set at these levels:

1.	State tax payments	$ 2,496,000
2.	Federal tax payments	23,206,000
3.	Imports from the Bay area	11,420,000
4.	Imports from the rest of the world	7,400,000
5.	Net saving	6,301,000
	Total	$50,823,000

These figures were estimated from the consumer expenditure survey and from outside data. Procedures involved the following steps:

The income distribution for Napa families and unrelated individuals was developed for 1959 on the basis of 1960 Census of Population data.[2/] This was updated to 1965 on the basis of growth in per capita income in money terms (as shown in Table 33). It was assumed that all income classes shared equally

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1/ All property taxes were allotted to their sector of origin, including households. Payments to the rentals sector, thus, are net of property taxes.

2/ U. S. Bureau of the Census, U. S. Census of Population: 1960. Vol. I . . ., pp. 6-250 and 6-435.

in the growth in income (26 percent). In addition, 11 percent was accounted for as underreporting of income. Operationally, income interval end points were multiplied by 1.40 (1.26 times 1.11), and the frequency within each redefined interval was thus the same as the 1959 frequency in the original interval. Then new intervals, in terms of thousand dollar increments, were defined; and frequencies were assigned to these intervals by linear interpolation. Thus, in the 1959 Census, the income class $0-$1,000 contained 0.0859 of the Napa County income units. By adjustment, it was then argued that the 1965 income range for this frequency was $0-$1,400. Then 0.714 (or 10/14) of the new range fell within the interval $0-$1,000. It was assumed that 0.714 times 0.0859 (or 0.0613) was a good estimate of the frequency in the latter interval. The distribution developed gave an overall average income of $8,608 which checked with a target figure of $8,600.[1/]

Given the estimated income distribution for 1965, the fraction of total income falling in a given class was calculated and used to weight the estimated fraction spent on a particular item by that class (see Table 33 for fraction spent on imports, etc., by income class[2/]). Table 43 presents the income distribution data employed in this process.

An overall average fraction was obtained and multiplied by total income to obtain spending on a given item. This was done for Bay area spending (or imports), rest-of-the-world spending, and state taxes. It was also the source of the rental estimate discussed above.

Household saving was estimated as 4.8 percent of income, using United States data.[3/] This implied a savings figure of $10.150 million for the County.

1/ Based on the adjusted average income of Table 5 ($6,835) times 1.26.

2/ Interpolation was carried out for the $0-$5,000 income classes.

3/ U. S. Office of Business Economics, Survey of Current Business, Vol. 46, No. 11 (November, 1966), p. 6.

TABLE 43

Income Distribution Estimates, Family and Unrelated Income
Napa County, 1959 and 1965

Income class	Family and unrelated income, estimated frequencies		Fraction of aggregate income received by income class, 1965
	1959	1965[a]	
dollars	1	2	3
Less than 1,000	.0859	.0613	.0036
1,000- 1,999	.0988	.0670	.0117
2,000- 2,999	.0809	.0679	.0197
3,000- 3,999	.0778	.0578	.0235
4,000- 4,999	.0918	.0560	.0293
5,000- 5,999	.1039	.0597	.0381
6,000- 6,999	.1070	.0655	.0495
7,000- 7,999	.0941	.0742	.0647
8,000- 8,999	.0750	.0756	.0747
9,000- 9,999	.0528	.0746	.0823
10,000-10,999	.1006	.0671	.0819
11,000-12,999		.1036	.1444
13,000-14,999		.1021	.1661
15,000-24,999	.0240	.0522	.1213
25,000 and over	.0074	.0154	.0895[b]

a/ Overall average income for this distribution is $8,600.

b/ Class assumed to have average income of $50,000.

Sources: U. S. Bureau of the Census, U. S. Census of Population: 1960. Vol. 1, Characteristics of the Population, Part 6, California, 1963, pp. 6-250 and 6-435; updating carried out on basis of Table 33, supra, p. 89; and for estimating procedures, supra, p. 88.

However, from this amount there was subtracted $1.349 million of new construction, treated as a component of savings which appeared previously as part of the flow to the construction sector.[1/] In addition, $2.5 million was subtracted as representing the portion of savings flowing into finance, etc., in the form of life insurance premiums.[2/] Hence, a net savings figure of $6.301 million emerged.

It may be noted that this net savings figure may be viewed as an offset to net investment other than construction, which was not estimated explicitly but which is an implicit component of the rest of the world sector. Since investment is usually treated as a final demand sector in any event, no particular problem arises because of this implicit rather than explicit treatment.

Finally, federal income tax is estimated as $23.206 million. This exact figure is a residual amount forcing the household column to add to the household row. It is close to the estimate of federal taxes obtained from the consumer expenditure survey, which was $26.651 million. However, if the United States effective average tax rate of 0.101 is used,[3/] the resultant estimated federal tax for Napa County is $21.1 million. Hence, the $23 million figure can be viewed as a compromise value as well as a balancing item.

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1/ In U. S. Bureau of Labor Statistics, op. cit., new construction by households is 0.36 of total construction. This was applied to the household flow into construction.

2/ In Institute of Life Insurance, Life Insurance Fact Book, 1965 (New York: Institute of Life Insurance, 1965), p. 6, a chart indicates that approximately one-fourth of individual savings is in the form of life insurance.

3/ U. S. Office of Business Economics, Survey of Current Business, Vol. 46, No. 11 (November, 1966), p. 6.

The Flow Table and Technical Coefficient Matrix

The component parts discussed in this section are combined into the Napa County flow table in Table 44.

Given total output for each sector, equal to the row sum of that sector, import flows into the economy were obtained by subtracting the sum of the column entries for the first 13 sectors (through households) from the row sum. (However, in the case of households, imports were estimated directly as noted above.)

As one of the columns of final demand, a "tourist" sector was set up. Estimates for tourist spending were developed from survey data and interviews. Tourist spending flows occur in wineries, trade, and services as might be expected.

Table 45 is an aggregated version of Table 44, showing flows by sector into exports, households, and County purchases other than by households. (Exports include sales to the Bay area, rest of the world, state and federal governments, and tourists.) These flows are then shown as a percentage of output of the sector involved. It is clear that Napa County is highly export oriented in terms of the percentage distribution of its sales. This is not too surprising, perhaps, in the light of its relatively small size. Even the trade and small manufacturing sectors have a significant portion of their sales flowing into exports, while livestock, agriculture, wineries, and large manufacturing exports approach 100 percent of sales.

With respect to share of total exports, households and large manufactures are the leading sectors with 35 and 30 percent, respectively, followed by trade, wineries, and livestock agriculture, each with 6 to 7 percent of the total. (The household share reflects the large amount of outside County employment of Napa residents.)

TABLE 44

Flow Table for Napa County Economy, 1965

Sector	Crop agri-culture	Livestock agri-culture	Wineries	Manufactures			Whole-sale and retail trade	Services	Construc-tion	Finance, insurance, real estate, and rentals	Transpor-tation, communi-cation, and utilities	Local govern-ment	House-holds (spending)	Bay area	Rest of the world	Tourists	Federal and state government	Total
				Large	Medium	Small												
	1,000 dollars																	
Crop agriculture	a/	42	3,500				1,699						392	2,169	328			8,130
Livestock agriculture						50							98	13,844	228			14,220
Wineries			165				88						41	4,167	9,116	789	108	14,474
Manufactures--large				989			54		2,417				298	23,039	44,450			71,247
medium	900		50	57			50		690				172	3,836	1,492			7,247
small			815			161	2,950	397	219	49			3,058	448	1,668			9,765
Wholesale and retail trade	162	71	34	154	49	18	27,904	748	2,844	85	98	982	88,544	12,077	548	1,847	1,124	137,289
Services	31	55	105	276	28	92	871	125	249	290	76	2	22,869	2,314	2,107	2,671	8	32,169
Construction			659				659		4,084	585		388	3,781	128			11,021	21,305
Finance, insurance, real estate, and rentals	163	142	304	1,023	116	276	7,750	1,420	134	699	492	308	27,192					40,019
Transportation, communi-cation, and utilities	186	360	811	4,600	276	374	4,374	698	395	359	346	645	6,134					19,558
Local government	1,383	484	230	1,175	123	175	1,561	387	92	137	88		5,008				8,330	19,173
Households (income to Napa residents)	3,455	3,498	4,012	13,700	1,885	3,916	24,889	20,091	7,549	21,993	7,596	16,279	3,110	40,357	1,750		37,440	211,520
(Subtotal)	(6,280)	(4,652)	(10,685)	(21,974)	(2,477)	(5,062)	(72,849)	(23,866)	(18,673)	(24,197)	(8,696)	(18,604)	(160,697)					
Imports, income payments to non-Napa residents, taxes to state and federal government, and net savings by households	1,850	9,568	3,789	49,273	4,770	4,703	64,440	8,303	2,632	15,822	10,862	569	50,823					227,404
Total	8,130	14,220	14,474	71,247	7,247	9,765	137,289	32,169	21,305	40,019	19,558	19,173	211,520	102,379	61,687	5,307	58,031	833,520

a/ Blanks indicate zero or not applicable.

TABLE 45

Aggregated Input-Output Flow Table, Napa County

Sector	Flows by destination						Sector share of all exports
	Sales						
	Exports	House-holds	Other than house-holds	Exports	House-holds	Other than house-holds	
	1,000 dollars			percent			
Crop agriculture	2,497	392	5,241	30.72	4.82	64.46	1.10
Livestock agriculture	14,072	98	50	98.96	.69	.35	6.19
Wineries	14,180	41	253	97.97	.28	1.75	6.24
Manufactures--large	67,489	298	3,460	94.72	.42	4.86	29.68
medium	5,328	172	1,747	73.52	2.37	24.11	2.34
small	2,116	3,058	4,591	21.67	31.32	47.01	.93
Wholesale and retail trade	15,596	88,544	33,149	11.36	64.49	24.15	6.86
Services	7,100	22,869	2,200	22.07	71.09	6.84	3.12
Construction	11,149	3,781	6,375	52.33	17.75	29.92	4.90
Finance, insurance, real estate, and rentals	a/	27,192	12,827		67.95	32.05	
Transportation, communication, and utilities		6,134	13,424		31.36	68.64	

(Continued on next page.)

TABLE 45--continued.

Sector	Flows by destination						Sector share of all exports
	Sales						
	Exports	Households	Other than households	Exports	Households	Other than households	
	1,000 dollars			percent			
Local government	8,330[b/]	5,008	5,835	43.45	26.12	30.43	3.66
Households	79,547	3,110	128,683	37.61	1.47	60.92	34.98
Total	227,404	160,697	217,835	37.53	26.52	35.95	100.00

a/ Blanks indicate not applicable.

b/ Transfer payments to local governments from state and federal government.

Source: Aggregated data of Table 44, supra, p. 138.

Table 46 concludes the work of this section by presenting the technical coefficient matrix. This consists of entries in a given column of the flow table divided by the output of the column sector. It may be interpreted as showing the cost structure for each industry in the economy. The next section presents the interdependence coefficient matrix for each of the alternative models discussed earlier. These matrices are then applied in analyses and forecasts for the Napa economy.

APPLICATIONS OF THE INPUT-OUTPUT TABLES FOR THE NAPA COUNTY ECONOMY

The Interdependence Coefficient Matrices

The interdependence coefficient matrices were obtained for the three models set forth above. These were (1) the 11-sector model with the business sectors endogenous; (2) the 12-sector model with the business sectors plus local government endogenous; and (3) the 13-sector model with business sectors, local government, and households endogenous. The interdependence coefficient matrices for these models appear as Tables 47, 48, and 49, respectively.

Each table lists column totals; the column total for an individual sector can be interpreted as the total multiplier effect, given an expansion of $1.00 in final demand on that sector. This value equals the expansion of all Napa production in response to the original $1.00 increase, including that $1.00.

In the 11-sector model, the multiplier effects range from 1.052 for livestock agriculture to 1.737 for construction. Wineries with 1.545 and wholesale and retail trade with 1.443 have relatively large multipliers.

The 12-sector model is quite similar to the 11-sector model since local government, now treated as endogenous, is a relatively small sector in dollar

TABLE 46

The Technical Coefficient Matrix

Sector	Crop agri-culture	Livestock agri-culture	Wineries	Manufactures			Whole-sale and retail trade	Services	Construc-tion	Finance, insurance, real estate, and rentals	Transpor-tation, communi-cation, and utilities	Local government	House-holds
				Large	Medium	Small							
Crop agriculture	a/	.00295	.24181				.01238						.00185
Livestock agriculture						.00513							.00046
Wineries			.01140				.00064						.00019
Manufactures--large				.01388			.00039		.11345				.00141
medium	.11070		.00345	.00081			.00036		.03239				.00080
small			.05631			.01649	.02149	.01234	.01027	.00122			.01446
Wholesale and retail trade	.01993	.00499	.00235	.00216	.00676	.00184	.20325	.02325	.13349	.00212	.00501	.05122	.41864
Services	.00381	.00387	.00725	.00387	.00386	.00942	.00634	.00389	.01169	.00725	.00389	.00010	.10812
Construction			.04553				.00481		.19169	.01463		.02024	.01788
Finance, insurance, real estate, and rentals	.02005	.00999	.02100	.01436	.01601	.02826	.05645	.04414	.00629	.01747	.02516	.01606	.12856
Transportation, communi-cation, and utilities	.02288	.02531	.05603	.06456	.03808	.03830	.03186	.02170	.01854	.00897	.01769	.03364	.02900
Local government	.17011	.03404	.01589	.01649	.01697	.01792	.01137	.01202	.00432	.00342	.00450		.02368
Households	.42497	.24599	.27720	.19229	.26012	.40102	.18129	.62455	.35433	.54956	.38838	.84906	.01470
(Subtotal)	(.77245)	(.32714)	(.73822)	(.30842)	(.34180)	(.51838)	(.53063)	(.74189)	(.87646)	(.60464)	(.44463)	(.97032)	(.75972)
Imports, income payments to non-Napa residents, taxes to state and federal government, and net savings by households	.22755	.67286	.26178	.69158	.65820	.48162	.46937	.25811	.12354	.39536	.55537	.02968	.24028

a/ Blanks indicate zero or not applicable.

Source: Aggregated data of Table 44, supra, p. 138.

TABLE 47

Eleven-Sector Interdependence Coefficients Matrix (of Size 11 x 11) for the Napa County Economy

Sector	Crop agri-culture	Livestock agri-culture	Wineries	Manufactures			Whole-sale and retail trade	Services	Construc-tion	Finance, insurance, real estate, and rentals	Transpor-tation, communi-cation, and utilities
				Large	Medium	Small					
Crop agriculture	1.000331	.003034	.244850	.000042	.000112	.000054	.015769	.000373	.002623	..000076	.000083
Livestock agriculture	.000003	1.000000	.000303	.000000	.000001	.005217	.000142	.000068	.000091	.000008	.000001
Wineries	.000017	.000004	1.011544	.000002	.000005	.000002	.000814	.000019	.000135	.000003	.000004
Manufactures--large	.000080	.000031	.006644	1.014114	.000047	.000067	.001520	.000132	.142609	.002128	.000062
medium	.110765	.000346	.032475	.000837	1.000027	.000025	.002490	.000086	.040608	.000610	.000028
small	.000675	.000215	.059135	.000153	.000275	1.017005	.027831	.013328	.017761	.001687	.000237
Wholesale and retail trade	.026450	.006700	.020032	.003406	.008970	.003116	1.257816	.029813	.209234	.006114	.006689
Services	.004730	.004132	.010325	.004355	.004224	.010052	.009172	1.004678	.017110	.007739	.004223
Construction	.000605	.000248	.057689	.000327	.000379	.000579	.008889	.001044	1.238856	.018479	.000522
Finance, insurance, real estate, and rentals	.024713	.011487	.032716	.016951	.018021	.031002	.075055	.047869	.025123	1.018951	.026670
Transportation, communi-cation, and utilities	.028826	.026278	.069735	.067057	.039339	.041446	.043578	.024174	.042504	.010255	1.018589
Total	1.197195	1.052475	1.545448	1.107244	1.071400	1.108565	1.443076	1.121584	1.736654	1.066050	1.057108

Source: Matrix inversion using 11-sector technical coefficient matrix from Table 46, supra, p. 142.

TABLE 48

Twelve-Sector Interdependence Coefficients Matrix (of Size 12 x 12) for the Napa County Economy

Sector	Crop agri-culture	Livestock agri-culture	Wineries	Manufactures			Whole-sale and retail trade	Services	Construc-tion	Finance insurance, real estate, and rentals	Transpor-tation, communi-cation and utilities	Local government
				Large	Medium	Small						
Crop agriculture	1.000480	.003064	.244902	.000057	.000127	.000070	.015784	.000385	.002633	.000080	.000088	.000866
Livestock agriculture	.000005	1.000001	.000303	.000000	.000001	.005217	.000142	.000068	.000091	.000008	.000001	.000009
Wineries	.000024	.000005	1.011546	.000002	.000006	.000002	.000815	.000019	.000135	.000004	.000004	.000044
Manufactures--large	.000598	.000135	.006826	1.014165	.000099	.000124	.001574	.000171	.142645	.002139	.000077	.003004
medium	.110931	.000379	.032534	.000854	1.000044	.000044	.002507	.000098	.040619	.000614	.000033	.000961
small	.000990	.000278	.059245	.000185	.000307	1.017039	.027864	.013352	.017783	.001694	.000246	.001824
Wholesale and retail trade	.038376	.009107	.024210	.004594	.010171	.004419	1.259071	.030711	.210064	.006381	.007023	.069083
Services	.004934	.004173	.010397	.004375	.004245	.010074	.009193	1.004693	.017124	.007743	.004229	.001184
Construction	.005073	.001149	.059254	.000772	.000829	.001068	.009359	.001381	1.239167	.018579	.000647	.025880
Finance, insurance, real estate, and rentals	.028450	.012241	.034026	.017323	.018397	.031411	.075448	.048150	.025383	1.019035	.026775	.021649
Transportation, communi-cation, and utilities	.035313	.027588	.072008	.067704	.039993	.042155	.044261	.024663	.042956	.010401	1.018770	.037577
Local government	.172876	.034899	.060567	.017223	.017412	.018890	.018194	.013019	.012041	.003867	.004830	1.001401
Total	1.398050	1.093019	1.615818	1.127254	1.091631	1.130513	1.464212	1.136710	1.750641	1.070545	1.062723	1.163482

Source: Matrix inversion using 12-sector technical coefficient matrix from Table 46, supra, p. 142.

TABLE 49

Thirteen-Sector Interdependence Coefficients Matrix (of Size 13 x 13) for the Napa County Economy

Sector	Crop agri-culture	Livestock agri-culture	Wineries	Manufactures			Whole-sale and retail trade	Services	Construc-tion	Finance, insurance, real estate, and rentals	Transpor-tation, communi-cation, and utilities	Local government	Households
				Large	Medium	Small							
Crop agriculture	1.009070	.007065	.252229	.003394	.004212	.006305	.020203	.009559	.010321	.007850	.005687	.012913	.013369
Livestock agriculture	.000608	1.000282	.000818	.000235	.000288	.005655	.000453	.000712	.000630	.000554	.000394	.000855	.000938
Wineries	.000562	.000256	1.012005	.000211	.000262	.000392	.001091	.000593	.000616	.000490	.000354	.000798	.000836
Manufactures--large	.005586	.002459	.011081	1.016103	.002471	.003744	.004140	.005498	.147109	.006651	.003328	.010000	.007763
medium	.113821	.001725	.034998	.001977	1.001418	.002141	.003994	.003184	.043205	.003228	.001916	.005014	.004497
small	.029273	.013452	.083370	.011172	.013757	1.037568	.042413	.043559	.043095	.027279	.018681	.041490	.044019
Wholesale and retail trade	.572859	.258056	.480104	.212237	.264342	.392354	1.534012	.601556	.688392	.489862	.355396	.818681	.831853
Services	.118505	.057072	.107269	.048497	.058253	.092506	.067615	1.125991	.118763	.110477	.078254	.160465	.176759
Construction	.034220	.014726	.084115	.012095	.014690	.022223	.024352	.032511	1.265252	.044945	.019645	.066758	.045364
Finance, insurance, real estate, and rentals	.197765	.091104	.178445	.083101	.098914	.154301	.162544	.228984	.176909	1.172193	.137133	.259108	.263516
Transportation, communi-cation, and utilities	.089625	.052885	.118334	.088803	.065821	.081575	.072199	.082670	.091561	.059530	1.054170	.113748	.084529
Local government	.206967	.050778	.089645	.030467	.033624	.043634	.035731	.049429	.042550	.034705	.027051	1.049213	.053058
Households	.995395	.463631	.849035	.386704	.473356	.722470	.512036	1.063115	.890816	.900412	.648794	1.396017	1.549205
Total	3.374256	2.013491	3.301448	1.894996	2.031408	2.564868	2.480783	3.247361	3.519219	2.858176	2.350803	3.935060	3.075706

Source: Matrix inversion using 13-sector technical coefficient matrix from Table 46, supra, p. 142.

terms. Here, the multipliers range from 1.063 for transportation, communication, and utilities to 1.751 for construction. The multiplier effect for all sectors increases, which must occur given an additional sector endogenous. The increase is particularly pronounced for crop agriculture, reflecting property taxes to local government.

In the 13-sector model, the inclusion of households has an important impact on the size of the multipliers, which now range from 1.895 for large manufactures to 3.935 for local government. The household multiplier per se is 3.076.

Differences in multipliers clearly reflect differences in export activity. The greater the exports relative to sales, the smaller the multiplier effect. This seems intuitively obvious; the less a sector is tied to the local economy, the less of an impact on the local economy there will be from an expansion of that sector's sales. This explains the results obtained above. Thus, livestock agriculture is highly export oriented and has a low multiplier. Local government is highly localized and has the highest multiplier. Again, the manufacturing sectors show this pattern clearly in the 13-sector model. Multiplier effects increase as we move from large to medium to small manufactures where export orientation decreases as size decreases. The figures are 1.895, 2,031, and 2.565, respectively. This pattern does not occur in the 11-sector and 12-sector models where multiplier effects are roughly equal for the manufacturing sectors. Hence, the 13-sector results must reflect the pattern of payments to households, with an increasing portion of returns on capital flowing outside the County as size increases.[1/]

1/ This result seems applicable to the study of "dual economies" in the analysis of developing economies.

It must be noted, as a critical aside, that multiplier effects ought not be interpreted as good per se unless one believes in growth for its own sake without regard to profitability or welfare. Thus, it would be rather naive (or at least involve a narrow point of view) to conclude that expansion of small (local) manufactures is "better" than that of large (export oriented) manufactures because it implies greater growth of economic activity and population. This neglects the rather important real-life criterion of profitability. It may be profitable to expand large manufactures and unprofitable to expand small manufactures.

Input-output analysis can be used to answer questions posed in the form, "What will happen if . . .?" Even if value judgments are specified beforehand, it is less applicable to questions as "What should happen?" The example of multiplier effects is a case in point. The basic economic question of optimal allocation of resources is not taken up here.

In what follows, some applications of the present input-output tables are made to aspects of the Napa economy and to forecasts thereof. The strictures above should be borne in mind in viewing these applications. In addition, the analysis must be viewed as experimental and exploratory. Often a good deal of guesswork was necessary to complete the work of a particular phase. Further refinement would be possible given detailed study of the problems involved.

Analysis and Conditional Forecasts for the Napa County Economy Using the Input-Output Tables

The following cases will be treated by applying the input-output tables developed in this study: (1) an example of the impact of large manufactures expansion; (2) the impact of Mare Island employment; (3) the impact of Lake Berryessa development in terms of tourist spending and induced housing; and

(4) the impact under each of three alternative land-use policies--development of the National Vineyard, continuation of the present Agricultural Preserve, and a return to conditions that held prior to the creation of the Preserve. These cases may be viewed as conditional forecasts (forecasts conditional on a specific event or development). In all cases, 1980 is the forecast target date. Then a general forecast for 1980 is presented on the basis of available information, following the present section and concluding the work of this study.

The first four cases involve the application of the 13-sector model, treating households as endogenous. This assumption is useful in these cases for the impact on household income and population can be traced out, given an initial change. In the general forecast, by contrast, population values are given by outside forecasts, and households are treated as exogenous. Here the 12-sector model was employed.

As initial items in developing projections, per capita income, population, and aggregate income are projected for Napa County in Table 50. Population is projected on the basis of an assumed 2.5 percent annual growth rate (Table 32 and attendant discussion). Per capita income was projected as follows: California per capita income grew at a rate of 1.5 percent in the 1948-1963 period (as opposed to a United States rate of 1.8 percent).[1/] Napa per capita income, as a ratio of California per capita income, has trended upward over time. Information on this ratio appears in Table 6 and was plotted on a graph. A freehand fit to these points yielded forecasts for the ratio of 0.91 in 1970, 0.95 in 1980, and 1.00 in 2000 and thereafter compared to a 1965 value of 0.874. These considerations implied that Napa per capita income

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1/ U. S. Office of Business Economics, Survey of Current Business, Vol. 45, No. 4 (April, 1965), p. 26.

TABLE 50

Projections of Per Capita Income, Population
and Aggregate Income, Napa County
1965, 1980, 2000, and 2010

Year	Per capita income	Population	Aggregate income
	dollars		1,000 dollars
1965	2,792	75,760	211,520
1980	3,794	110,000	417,340
2000	5,363	181,000	970,703
2010	6,229	232,000	1,445,128

Sources:

1965: Table 6, supra, p. 17.

1980, 2000, and 2010: Per capita income--obtained using California growth rate and projected increase in Napa County level relative to California. California rate based on U. S. Office of Business Economics, Survey of Current Business, Vol. 45, No. 4 (April, 1965), p. 26.

Population--obtained using 2.5 percent growth rate, Table 32, supra, p. 85.

in 1980 would be 1965 income ($2,792) times the California growth rate effect (1.25 or $(1.015)^{15}$) times the increase-in-ratio effect (1.087). The resultant was $3,794. Similar considerations led to a year 2000 per capita income of $5,363 and a 2010 figure of $6,229.[1/] The multiplication of population and per capita income yielded aggregate income. Napa aggregate income is projected as roughly $400 million in 1980, $1 billion in 2000, and $1.5 billion in 2010, relative to a 1965 figure of $211.5 million.

The remainder of this section is devoted to the impact and forecast studies outlined above.

Impact of Large Manufactures Expansion

Kaiser Steel has a contract to fabricate segments of steel lining for tunnels throughout the 18 miles of underground tracks of the Bay Area Rapid Transit District (BART). The amount of the contract is $16 million.[2/]

The impact of this contract might be investigated as follows: Let us assume the life of the present program is four years on the basis of the BART schedule.[3/] This yields an estimate of $4 million of fabrication per year. This full amount may be an increment to Kaiser production, and that will be assumed here. (Alternatively, part or all may have replaced other work.) The contract may be a one-time situation, with no additional work beyond the four-year term assumed above. However, if BART expands its lines, the work may go on for an additional time.

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1/ Assuming three persons per household. This is equivalent to average consumer unit income of around $18,500.

2/ "Jaws for Bay Transit Tunnels," San Francisco Chronicle, January 3, 1967, p. 7.

3/ This assumption seems reasonable on the basis of telephone conversations with Kaiser Steel and BART officials, February 23, 1967.

Table 51 exhibits the resultant expansion by sector for both the 12-sector and 13-sector models. The 13-sector model appears applicable in gauging the full impact of the change per year since it exhibits induced employment effects--in particular, the spending of additional workers brought into the economy. (The 12-sector model might be applicable only in the rather extreme case where increased employment came by way of the hiring of unemployed persons who were receiving approximately the same level of income while unemployed. In this case, if there were a negative offset to household spending equal to new wages generated, then the 12-sector results would appear applicable.)

For the 13-sector model, the $4 million expansion in large manufactures leads to an additional $64,000 expansion in that sector, to an additional $53,000 expansion in other manufactures, to a $1.8 million expansion by all other private sectors, and, finally, to a $1.5 million expansion in household income.

Impact of Mare Island Employment

As noted above, a number of Napa residents are employed at the Mare Island Shipyard. That employment in 1965 was approximately 2,500 persons.[1/] Given the average income for families and unrelated persons of $8,600 from Table 43 and assuming that this applies to the 2,500 persons employed at Mare Island, total income of $21.5 million is estimated as having been obtained from Mare Island employment. Given the household interdependence coefficient of 1.55 (Table 49), it can be inferred that Mare Island employment generates $33.3 million of Napa County income. Put another way, the loss (or gain) of a job at Mare Island implies a cumulative ultimate loss (or gain) of 1.55 jobs in the Napa County economy.

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1/ Information secured from the Employment Office, Mare Island Naval Shipyard, March 25, 1967.

TABLE 51

Estimated Impact of a $4 Million Expansion in Final Demand for Large Manufactures by Sector, Napa County

Sector	Expansion	
	12-sector model	13-sector model
	1,000 dollars	
Crop agriculture	0	14
Livestock agriculture	0	1
Wineries	0	1
Manufactures--large	4,057	4,064
medium	3	8
small	1	45
Wholesale and retail trade	18	849
Services	18	194
Construction	3	48
Finance, insurance, real estate, and rentals	69	332
Transportation, communication, and utilities	271	355
Local government	69	122
Households	a/	1,547

a/ Not applicable.

Sources: Application of 12-sector model and 13-sector model from Tables 48 and 49, supra, pp. 144 and 145, respectively.

Impact of the Lake Berryessa Development

The impact of Lake Berryessa on the Napa economy can be viewed in two parts: (1) that due to tourist expenditures and (2) that due to induced housing. The first is relatively easy to quantify and treat within an input-output framework. The second poses much more difficult problems. In both parts, the 13-sector model is relevant for the Lake Berryessa development clearly has generated employment and population growth.

In handling the impact of tourist expenditures, 1965 spending was set at $1.430 million at the Lake Berryessa resorts plus a net figure of $50,000 to local government. (This latter item refers to a rounded figure for Lake Berryessa Park Commission receipts, net of the franchise fees from concessionaires. The latter was omitted to avoid double counting.) Of the resort sales, 40 percent was allocated to retail trade, covering sales of eating and drinking places, and 60 percent was allocated to services.[1/]

Sales in 1980 were set at 2.5 times the 1965 level on the basis of the forecast developed above. The resultant impact on the Napa economy is estimated in Table 52. The total output generated is 2.97 times the initial sales. Household income generated is $1.275 million. Given a per capita income of $2,792 in 1965, estimated induced population growth is 457.[2/] Per capita income is projected as $3,794 in 1980.[3/] This implies a 1980 induced population total of 840, given a household income increment of $3.187 million.

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1/ Based on telephone conversations with Lake Berryessa resort operators, January, 1967.

2/ This squares well with the concessionaire and park employment figure of around 100 as noted in the section on Lake Berryessa operations, supra, p. 70. Given 3.0 persons per family unit and a household interdependence coefficient of 1.5, then 100 employees corresponds to a population of 450 (100 times 3 times 1.5).

3/ The source of this projection is discussed above.

TABLE 52

Impact of the Lake Berryessa Development

Sector	Impact of tourist expenditures				Estimated maximum impact of induced housing	
	Final demand		Resultant output		Final demand	Resultant output
	1965	1980	1965	1980	1980	1980
	1,000 dollars					
Crop agriculture	a/		20	51		56
Livestock agriculture			1	2		32
Wineries			1	3		29
Manufactures--large			8	19		265
medium			5	13		153
small			64	159		1,501
Wholesale and retail trade	572	1,430	1,435	3,586		28,373
Services	858	2,145	1,013	2,532		6,029
Construction			45	113		1,547
Finance, insurance, real estate, and rentals			302	756		8,988

(Continued on next page.)

TABLE 52--continued.

Sector	Impact of tourist expenditures				Estimated maximum impact of induced housing	
	Final demand		Resultant output		Final demand	Resultant output
	1965	1980	1965	1980	1980	1980
	1,000 dollars					
Transportation, communication, and utilities			118	295		2,883
Local government	50	125	115	288		1,810
Households			1,275	3,187	34,108	52,840
Total	1,480	3,700	4,402	11,004	34,108	104,506

a/ Blanks indicate zero.

Source: See section, Impact of the Lake Berryessa Development, pp. 154-160.

Turning to induced housing, Table 52 lists the estimated maximum impact of housing induced by the Lake Berryessa development as of 1980. Details involved in the development of this estimate appear in Table 53.

Farnum Kerr Associates and Frederick L. Hotes list projections of Napa population and of Lake Berryessa-Capell Valley population for 1981 and 2010.[1/] (Capell Valley growth is usually treated as attributable to the Lake Berryessa development.[2/]) The Berryessa-Capell population is given in terms of a resident-nonresident breakdown, and 1981 is treated as equivalent to 1980 in the present application.

The Kerr Associates-Hotes figures show the Berryessa-Capell region growing at a markedly faster rate than the County so that its share of County population moves from less than 1 percent in 1960 to over 5 percent in 1981 and to 9 percent in 2010.

This projection is in marked contrast to that made by the Napa County Planning Department as shown in Table 53. Here, Berryessa's share of County population declines between 1966 and 2000 and is always less than 1 percent of the total. For the 1966-2000 period, the projected Napa County population growth rate here is 3 percent, while the Berryessa growth rate is 2.2 percent.

The estimated population impact of the Berryessa Highlands development is also shown in Table 53.[3/] The resident population here is above the Napa County Planning Department figure and about one-seventh of the Kerr Associates-Hotes figure. The nonresident population figure is more than half the Kerr Associates-Hotes figure. Since the Berryessa Highlands development can be

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1/ Table 31, supra, p. 82, for corresponding land-use projections.

2/ For an example, see Waelti, op. cit.

3/ Based on the discussion in the section, Other Key Growth Sectors, supra, pp. 68ff.

TABLE 53

Population Data on Lake Berryessa Area
1960, 1966, 1980, 2000, and 2010

	1960	1966	1980[a]	2000	2010	1966/1960	1980/1960
Farnum Kerr Associates and Frederick L. Hotes							
(1) Napa County population	67,200	[b]	149,680		399,690		2.22
(2) Resident population							
Lake Berryessa area	280		4,030		8,300		
Capell Valley	130		4,350		27,700		
Total	410		8,380		36,000		20.44
(3) Nonresident population[c]							
Lake Berryessa area			6,100		18,300		
Capell Valley			2,800		3,500		
Total			8,900		21,800		
(4) Lake Berryessa-Capell Valley as fraction of Napa County (resident)	.0061		.0560		.0901		
(5) Napa County population exclusive of Lake Berryessa-Capell Valley	66,790		141,300		363,690		2.12
(6) Lake Berryessa-Capell Valley if same growth	410		870		2,235		2.12
(7) Additional population (above Napa County growth rate)			7,510		33,765		
Napa County Planning Department							
(8) Napa County population	65,890	79,588	120,337[d]	217,210		1.21	1.83
(9) Lake Berryessa population	298	675	925[d]	1,450		2.27	3.10
(10) Lake Berryessa/Napa County	.0045	.0085	.0077	.0067			
Estimated Population in Lake Berryessa Highlands (Lake Berryessa area)[e]							
(11) Resident			1,200				
(12) Nonresident			4,800				

(Continued on next page.)

TABLE 53--continued.

a/ Farnum Kerr Associates and Frederick L. Hotes use 1981 as their projection date.

b/ Blanks indicate estimate for year and area not developed.

c/ Refers to "weekend summer home population."

d/ Interpolated on the basis of implicit growth rates, Napa County Planning Department (cited below): growth rate for Napa--.03; growth rate for Lake Berryessa--.022 (1966 population level used as base).

e/ It is assumed that 400 homes are those of residents and 1,600 of nonresidents. In addition, it is assumed that average family size is three persons--leading to the population estimates presented.

Sources:

(1) and (2):	Farnum Kerr Associates and Frederick L. Hotes, Napa County Water Needs Study and Plan (Napa, California, 1961), pp. A-9 and A-17.
(3):	Ibid., p. A-18.
(4), (5), (6), and (7):	Calculated.
(8), (9), and (10):	Napa County Planning Department, Population Data of Napa County (Napa, California, 1966), Tables 8 and 9, pp. 19 and 20, respectively.
(11) and (12):	From information developed in section, Recent Housing Development (supra, p. 74).

viewed as one of a number of present and prospective developments, the Kerr Associates-Hotes figure seems fairly reasonable. (The full impact of the Berryessa Highlands development is projected for 1975; it is argued here, then, that there will be additional developments started in the next 5-10 years to more or less confirm the Kerr Associates-Hotes projection.)

Accepting the Kerr Associates-Hotes estimates, the following procedures were employed: The Napa County population, exclusive of Berryessa-Capell, was obtained by subtraction; and 1980 as a fraction of the 1960 population was obtained. The same growth fraction was applied to the 1960 Berryessa-Capell population, giving the 1980 population for the region if it grew at the same rate as the rest of the County. This was subtracted from the total population for the region to yield an increment above the County growth pattern, presumably induced by Lake Berryessa development.[1/] This is a maximum estimate because it involves the assumption that this induced growth stems from the in-migration of persons who would not have been Napa County residents in the absence of Lake Berryessa. Insofar as some of the growth (above the level corresponding to average County growth) may involve relocation of Napa County residents, this figure is an overstatement.

The induced resident population, then, was estimated as 7,510 in 1980. It was now assumed that the nonresident population spent one-sixth of its time and income in Napa County (assuming one full month of residence and one weekend per month for the rest of the year at the Berryessa home). This yielded an increment of 1,480 person-equivalents (8,900 divided by 6). Hence, total induced population was set at 8,990 (7,510 plus 1,480). This population figure was multiplied by the projected 1980 per capita income figure of $3,794 to

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1/ This is similar to a procedure applied by Waelti, op. cit.

yield a total household income figure of $34.108 million. Treating this as final demand generated the induced output presented in Table 52.

Treating the household income as a component of final demand is legitimate, in a strict sense, if all residents involved are (1) employed outside the County or (2) retired with income consisting of property income obtained outside the County. However, for residents actually employed in the County, it would appear that essentially the same results would be obtained if these residents had been attracted in from outside the County. In this case, supply can be viewed as generating a demand as it were; the increased labor force would generate increased sales by industries in the economy. Increased sales to the export market would be a component of final demand, and the same sort of effects would be generated as those presented here. However, in the extreme case where all residents involved are employed inside the County, the final equilibrium situation would appear to involve total household income of $34 million rather than the induced figure of $53 million; on the other hand, sales by other Napa sectors could be expected to be well above those presented in Table 52. This problem arises because it is not obvious whether the household income increment is to be treated as a component of final demand or as an addition to total sales only.

In any event, results here are well above those generated by tourism; as noted above, however, there may be some overstatement of impact.

Impact of Grape Land Preservation

Grape land preservation has been discussed in some detail in earlier sections of this report. At this point, the input-output tables will be used to gauge the impact of alternative preservation policies. The alternative policies are (1) establishment of a National Vineyard, (2) continuation of the present Agricultural Preserve, and (3) a return to previous zoning. By

use of the Kerr Associates-Hotes land-use projections of Table 31, it was shown that 3,115 acres of land are at issue. This is the projected increment of land in 1980 that would move into urban use in the Calistoga, St. Helena, and Oakville-Rutherford area if there were a return to previous zoning.[1/]

In considering the alternative policies here, the National Vineyard will be compared to the situation given a return to previous zoning. It will be shown that marked differences in impact occur between these policies. Then the National Vineyard will be compared to the Agricultural Preserve. Results under these policies will be shown to be approximately of the same order of magnitude so that they are quite similar in economic impact.

In considering the National Vineyard versus a return to previous zoning, the starting point is that all of the 3,115-acre projected increment in urban use is retained in agriculture, given the National Vineyard. A maximum estimate of the impact can then be obtained by estimating incomes generated under the alternative distributions of land use and applying this income in the input-output 13-sector model.

This is the maximum impact because it disregards possible substitutions. Thus, much, most, or even all of the projected residential and industrial expansion of 3,115 acres might simply occur in another part of the County. It seems likely, however, that some net reduction of total expansion would in fact occur. A conservative guess might place this at 10 percent of the total; that is, given the National Vineyard, it is guessed that 90 percent of the

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projected expansion--or 2,800 acres--will occur elsewhere in the County and 10 percent--or 300 acres--will not occur. Of course, a rigorous estimate of a "proper" percentage here is an extremely difficult problem, and no attempt to solve it will occur beyond the arbitrary 10 percent guess.

Nevertheless, it is plausible that some reduction will occur under the hypothesis that demand for housing and industrial land is not perfectly inelastic. The removal of acreage reduces supply (shifts total supply to the left) so that some price increase and quantity decrease is likely. The quantity decrease corresponds to a reduction in household income and industrial output in the present analysis.

Income generated under agricultural land use is estimated as follows: The 1961 distribution of land was estimated as 0.65 in vineyards, 0.25 in orchards, and 0.10 in pasture, based on the Kerr Associates-Hotes land-use map for 1961.[1/] The value of grape production per acre was investigated for the period 1955-1965 using values obtained from Table 14 deflated by the general price level. An upward trend was manifest, and a 1980 projection of $550 an acre was made on the basis of this trend. Gross returns per acre for prunes, pears, and walnuts, if anything, showed a declining trend for the period. Returns for pasture are presumably well below grapes. Hence, it was decided to allocate all the 1980 acreage to grape production under the argument this would be the general tendency in any event. Thus, 3,115 acres yielding $550 per acre in grape sales implies total sales of $1.7 million. In 1965, 27 percent of Napa grape production was exported and 73 percent was used in wine production in Napa (based on Table 18).

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1/ Kerr Associates and Hotes, op. cit., unpaged maps following p. 5.

By assuming these percentages apply in 1980, projected exports of $460,000 and Napa use of $1.240 million are obtained. If the land in question is removed from grape production, it seems likely that some substitute supplies might be developed from other sources. However, it might be argued that corresponding winery operations might shift out of the County as well. As an extreme case, then, it was assumed that to this grape production there is a corresponding amount of wine produced equal to $4.133 million. (This figure is based on the grape share of wine cost, estimated as 0.30 in Table 22.) Hence, flows into final demand were set at $460,000 from crop agriculture (grapes exported) and at $4.133 million from wineries (wine exported). The resultant output, reflecting multiplier effects, appears in Table 54. Total output is around $15 million; household income, as a component, amounts to roughly $4 million.

In the urban land-use case, the 3,115 acres are distributed as 1,500 acres in low-density residential use, 1,420 acres in medium-density residential use, and 195 acres in industrial use. Low-density residential use consists of parcels ranging from 1/2 to 5 acres, with an assigned average here of 3 acres. Medium-density residential use consists of parcels ranging from 5,000 square feet to 1/2 acre, with an assigned average here of 1/3 acre per parcel. For the low-density use, with 3 acres per parcel, 500 parcels are implied. For the medium-density use, with 1/3 acre per parcel, 4,260 parcels are implied. Given three persons per household, this implies a total of 14,280 persons moving into the area, assuming the 1980 per capita income of $3,794 yields $54 million in household income.

TABLE 54

The Impact of a National Vineyard in 1980: A Comparison of Exclusive Agricultural Use Versus Urban Use for 3,115 Acres in Terms of Multiplier Effects

Sector	National Vineyard: land use exclusively agricultural		Return to previous zoning: land use exclusively urban	
	Flow into final demand	Output	Flow into final demand	Output
	1,000 dollars			
Crop agriculture	460	1,507	a/	739
Livestock agriculture		4		52
Wineries	4,133	4,183		46
Manufactures--large		48		430
medium		197	25,000	25,249
small		358		2,430
Wholesale and retail trade		2,248		46,038
Services		498		9,835
Construction		363		2,518
Finance, insurance, real estate, and rentals		828		14,964

(Continued on next page.)

TABLE 54--continued.

Sector	National Vineyard: land use exclusively agricultural		Return to previous zoning: land use exclusively urban	
	Flow into final demand	Output	Flow into final demand	Output
	1,000 dollars			
Transportation, communication, and utilities		530		5,652
Local government		466		3,356
Households		3,967	47,400	85,266
Total	4,593	15,197	72,400	196,575

a/ Blanks indicate zero.

Sources: See section, Impact of Grape Land Preservation, for sources of flows into final demand, pp. 160-170. The 13-sector matrix of Table 49 was applied to develop output figures, supra, p. 145.

On the basis of available evidence, manufacturing sales per acre were estimated as roughly $130,000.[1/] The 195 acres in industrial use are then seen as generating roughly $25 million in sales. Assuming that 0.26 of this sum is paid to households (on the basis of the medium manufactures case), roughly $6.6 million is paid to households. This may be viewed as a component of the $54 million figure above so that a net figure of $47.4 million in household income is obtained.

To summarize this case, then, flows into final demand are estimated as $25 million for manufactures (set as medium manufactures rather arbitrarily) and $47.4 million for households. The corresponding output for this case appears in Table 54. Household income totals roughly $85 million. This is about 20 times the household income occurring when the land is exclusively agricultural. (An interesting sidelight is that agricultural production for the urban-use case is above that for the exclusively agricultural case. This reflects increased household demand with urbanization.) Total output is around $200 million, roughly 13 times that occurring under the National Vineyard.

With the conservative "guesstimate" of a 10 percent reduction in total expansion, given the National Vineyard, the drop in household income is $8 million as compared to the $4 million figure gained through exclusive agricultural use, a net drop of $4 million.[2/] The corresponding net drop in total output is around $5 million.

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1/ Based on Table 37 and a datum of 684 industrial acres in Napa County, Kerr Associates and Hotes, op. cit., p. A-27.

2/ The problem touched on in the Berryessa case also applies here: It is not clear that the $47 million household figure ought to be allocated to final demand; it may be a part of total sales, with increases in sales to final demand occurring for other sectors. In this case, a 10 percent allocation drops household income by $4.7 million.

Even if these highly speculative figures were accepted, of course, it could be argued nevertheless that a National Vineyard would be a "good" thing, with benefits obtained from preservation outweighing any real losses in income. (Note that income losses guessed at here are not necessarily "real" losses to the economy but may be merely shifts from Napa to other counties. Problems of "malallocation" effects possibly involved seem outside input-output analysis.) The kinds of figures developed here, however, tend to indicate why resistance to long-term preservation can be expected to be strong.

Similar effects--and resistance--could be expected under Agricultural Preserve zoning. This can be seen by comparing that case to the National Vineyard.

The National Vineyard is projected as 40,000 acres or roughly 15,000 acres above the Agricultural Preserve. However, those 15,000 acres are forest land and wasteland of relatively steep slope, given the land-use data developed earlier. The primary difference between the National Vineyard and the Agricultural Preserve is that in the former the 3,115 acres at issue would remain in agricultural use, while in the latter the land could be used for very low-density residential development. Lot size must be 20 acres or more under Agricultural Preserve zoning. This lot size is quite large, relative to usual residential use,[1/] and it seems plausible that only high-income families could build on such a lot.[2/] Under such conditions, total output multiplier effects

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1/ In the United States as a whole, only 4 percent of single-family residences are on lot sizes above two acres; John B. Lansing and Eva Mueller with Nancy Barth, Residential Location and Urban Mobility, University of Michigan, Survey Research Center (Ann Arbor, 1964), p. 2.

2/ At $2,500 per acre, land alone would cost $50,000 for a 20-acre parcel.

for agricultural use and for urban use turn out to be roughly the same magnitude. In this sense, then, the Agricultural Preserve and the National Vineyard yield about the same economic impact.

This conclusion is based on the following argument: Assume that the income of a family building on a 20-acre parcel is three times the average. In 1965 this amounted to about $25,000; for 1980 the figure is projected as $34,140.[1/]

Hence, 20 acres in residential use involve a household income of $34,140. Using this figure as a source of final demand, multiplier effects can be traced out, again using the 13 x 13 interdependence coefficient matrix. These effects appear in Table 55, which also presents corresponding effects for 20 acres of grape production. Total output generated for each 20-acre allocation is roughly the same at $100,000. In this sense, the Agricultural Preserve and the National Vineyard have roughly the same impact. (However, household income under the Agricultural Preserve case is about twice that of the National Vineyard so that the former has greater economic impact in terms of this measure.)

The comparison has been made in terms of the substitution of one household's 20 acres of residential use for 20 acres of grape production. It seems unlikely that all 3,115 acres at issue would move into such residential use. Thus, the Kerr Associates-Hotes projection includes 1,500 acres in low-density use, defined as 3 acres per parcel. It is plausible that fewer total acres would be used in developing 20-acre parcels because of lower demand for such large parcels.

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1/ Per capita income in 1965 of $2,792 yields a family income of $8,376 (based on three persons per family); projected per capita income in 1980 of $3,794 in turn yields a family income of $11,380 (Table 50). It seems plausible to argue that a family building a residence on a 20-acre parcel would have an income three times the County average, or $25,100 in 1965 and $34,140 in 1980. (Table 43 shows that only 1.5 percent of the Napa population had an income of $25,000 or more in 1965.)

TABLE 55

Comparison of Low-Density Housing Under Agricultural Preserve Zoning to Grape Production in Terms of Multiplier Effects, Napa County

Sector	Multiplier effects	
	One household at low-density use (20 acres)	Grape production (20 acres)
	dollars	
Crop agriculture	456	9,675
Livestock agriculture	32	26
Wineries	29	26,854
Manufactures--large	265	308
medium	154	1,265
small	1,503	2,298
Wholesale and retail trade	28,399	14,432
Services	6,035	3,197
Construction	1,549	2,330
Finance, insurance, real estate, and rentals	8,996	5,316
Transportation, communication, and utilities	2,886	3,403
Local government	1,811	2,992
Households	52,890	25,468
Total	105,005	97,564

Sources: See section, Impact of Grape Land Preservation, for sources of flows into final demand, pp. 160-170. The 13-sector matrix of Table 49 was applied to develop output figures, supra, p. 145.

It can be concluded, then, that differences between the National Vineyard and Agricultural Preserve zoning will not be marked in terms of multiplier effects.

A General Forecast of Production for 1980

Input-output analysis is often used as a general forecasting device. Given projections of final demand for some future period, corresponding output projections are obtained. To conclude the work of this study, forecasts of Napa County outputs for 1980 were developed in such fashion. Primary reliance was placed on the 12-sector model. This was done because population and per capita income were projected initially and treated as determining factors so that household spending was best treated as exogenous. By this assumption, differences in spending patterns over time could be incorporated in the forecasts.[1/]

As an initial step in developing forecasts, the distribution of income for Napa County families and unrelated individuals was projected for 1980. (This was carried out using procedures discussed in Table 43 for the 1965 projection. Growth in average income was taken as 36 percent as shown in Table 50.) Results appear as Table 56 in terms of fraction of income units in a given interval and in terms of fraction of total income obtained by those units.[2/] Income units with an income above $10,000 amounted to about

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1/ Results were also obtained for the 11-sector model (local government exogenous) and the 13-sector model. The 11-sector model results were essentially the same as those for the 12-sector model; this was because no spending pattern changes were incorporated for local government in the 11-sector model. The 13-sector model results were close to the 12-sector model, but some differences occurred because of the implicit assumption of a constant pattern of consumer spending.

2/ Obtained by multiplying fraction of total recipients by average income for the given intervals and dividing each result by the sum of all the results.

TABLE 56

Projected Income Distribution and Share of Total Income
Families and Unrelated Individuals
Napa County, 1980

Income interval dollars	Fraction of income units	Fraction of total income
Less than 1,000	.0451	.0019
1,000- 1,999	.0478	.0061
2,000- 2,999	.0494	.0105
3,000- 3,999	.0499	.0149
4,000- 4,999	.0431	.0166
5,000- 5,999	.0418	.0196
6,000- 6,999	.0417	.0231
7,000- 7,999	.0439	.0281
8,000- 8,999	.0475	.0345
9,000- 9,999	.0511	.0414
10,000-10,999	.0547	.0490
11,000-12,999	.1107	.1134
13,000-14,999	.1016	.1214
15,000-24,999	.2218	.3407
25,000 and over	.0499	.1788

Sources: Tables 43 and 50, supra, pp. 135 and 149, respectively.

one-third of all units in 1965 and are projected as including more than half of all units in 1980 (values are in terms of 1965 price levels).

On the basis of the 1965 and the 1980 income distribution projection and the information developed in the consumer expenditure survey (Tables 33, 35, and 43), per capita projections of 1980 spending were developed for a number of items. These included spending by locale (Napa County, Bay area, and the rest of the world); spending for federal and state taxes; and spending for rent, utilities, and construction.

Table 57 presents these projections in terms of 1980 per capita values relative to 1965. Table 57 also presents projections for 1980 relative to 1965 values for per capita income and population. The 1980 population projections all take account of recent declining rates of population increase attendant on declining birth rates.[1/] The information in Table 57 served as a basis for forecasting components of final demand.

Some particular aspects of note are (1) the relative decline in per capita spending within Napa County (relative to spending in the Bay area and the rest of the world), reflecting increased income and the spending pattern noted in Table 35 and (2) the large increases in state and federal tax payments per capita, reflecting graduated income taxes. It was assumed here that tax rates would remain unchanged and that government spending on such programs as aid to cities and space exploration would continue to expand. An alternative assumption would be that taxes, as a percent of income, will remain constant so that tax rates will decline as income increases.

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1/ The Napa rate of increase was set at 2.5 percent on the basis of previous discussion here. The state of California rate was set at 2.7 percent and the United States rate at 1.3 percent, representing a reduction of 15 percent relative to the 1960-1965 average. This reduction is in line with the most recent forecasts of the California Department of Finance. In particular, see Table 32, supra, p. 85.

TABLE 57

Projections for 1980 Relative to 1965 Values

Category	Napa County	Bay area	California	United States
Per capita income	1.36	1.25	1.25	1.31
Population	1.45	1.42	1.49	1.21
Total income	1.97	1.78	1.86	1.59
Per capita spending by Napa County residents:				
in Napa County	1.26			
in Bay area	1.51			
in rest of the world	1.81			
for federal taxes	1.69			
for state taxes	2.38			

Sources:

Table 50, supra, p. 149.

Napa County Planning Department, Population Data on Napa County (Napa, California, 1966), pp. 7 and 25.

U. S. Office of Business Economics, Survey of Current Business, Vol. 45, No. 4 (April, 1965), p. 26.

Consumer expenditure survey, Tables 33, 35, and 43, supra, pp. 89, 92, and 135, respectively.

The final demand components were household spending within the County, exports to the Bay area and to the rest of the world, tourist spending in Napa County, and federal and state government expenditures (in this model, local government is endogenous). The final demand projections are presented in Table 58. Procedures used in developing those projections will be discussed in brief fashion at this point. More detail appears in the notes to Table 58.

Household Spending

Household purchases from agriculture, wineries, manufactures, and wholesale and retail trade were obtained by multiplying the 1965 value by 1.83. That scale factor reflects the growth of Napa population and growth in spending within the County (Table 57). Household consumption of services reflects United States trends in service consumption and the increase in Napa per capita income relative to United States levels. Household construction levels were based on consumer expenditure survey data on home repairs by income class (Table 35). Data from that survey and population and income growth factors were used to project household expenditures on the remaining sectors--finance, etc.; transportation, etc.; and local government.

Exports

For agriculture other than grape production, income elasticity estimates presented by Heady were utilized in developing export forecasts.[1/] The income elasticity of Napa grapes was set at 1.5 on the basis of the earlier discussion of the topic. Projected per capita income and population increases

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1/ Earl O. Heady, Agricultural Policy Under Economic Development (Ames: Iowa State University Press, 1962), p. 226.

TABLE 58

Components of the Final Demand Forecast, Napa County, 1980

Producing sector	Purchases by final demand sector				
	Households	Exports to Bay area	Exports to the rest of the world	Tourists	Federal and state government
	1	2	3	4	5
	1,000 dollars				
Crop agriculture	717	3,687	587	a/	
Livestock agriculture	179	23,012	381		
Wineries	75	8,125	16,135	1,578	290
Manufactures--large	545	47,690	82,055		
medium	315	7,941	2,754		
small	5,596	927	3,079		
Wholesale and retail trade	162,035	21,497	975	4,363	3,035
Services	48,750	4,443	4,235	6,200	22
Construction	8,243	273			29,757
Finance, insurance, real estate, and rentals	49,258				
Transportation, communication, and utilities	10,182				
Local government	9,876				22,491

(Continued on next page.)

TABLE 58--continued.

a/ Blanks indicate zero.

Sources:

Col. 1: For crop agriculture, livestock agriculture, wineries, manufactures (large, medium, and small), and wholesale and retail trade, 1965 value multiplied by 1.83; the latter figure obtained as the product of 1.45 (Napa population growth factor) and 1.26 (spending within County growth factor); Table 57, supra, p. 173.

For finance, insurance, real estate, and rentals, 1965 component scaled by 1.97 (population and income growth factors); rental component scaled by 1.74 (from consumer expenditure survey results).

For transportation, communication, and utilities, 1965 figure scaled by 1.66 based on consumer expenditure survey results, Table 35, supra, p. 92.

For local government, 1965 figure scaled by 1.97 (population and income growth factors).

Cols. 1 and 2: For construction, based on consumer expenditure survey data on home repairs by income class, Table 35, supra, p. 92. Two-thirds of household expenditure on construction is for repair construction; it was assumed the remaining one-third for new construction changed in the same fashion as repair construction.

Cols. 1, 2, and 3: For services, United States per capita consumption of services estimated as growing at an annual rate of 2.4 in the postwar period. U. S. Office of Business Economics, Survey of Current Business, Vol. 30, No. 7 (July, 1950), pp. 24 and 25, and Vol. 46, No. 7 (July, 1966), p. 20. Napa income growth per capita from 1965 to 1980 is projected as 1.04 the United States amount. For Napa, 1965 value was multiplied by 2.13, equal to 1.42 (services consumption growth for United States) times 1.04 (income differential) times 1.45 (population). For California, the income differential factor is .954; and it was assumed that Napa service sales to the rest of the world were in California. Resultant scaling for Bay area is (1.42) (.954) (1.42) = 1.92; for the rest of the world, (1.42) (.954) (1.49) = 2.01. The last entry on the left side is the population growth factor; Table 57, supra, p. 173.

(Continued on next page.)

TABLE 58--continued.

Cols. 2 and 3: For crop agriculture, income elasticity of components obtained from Earl O. Heady, Agricultural Policy Under Economic Development (Ames: Iowa State University Press, 1962), p. 226, for field and truck crops and fruit other than grapes. The income elasticity for grapes is set at 1.5 on the basis of earlier discussion. The distribution of crop sales was obtained from Table 18, supra, p. 44, and from Napa County Agricultural Commissioner, Agricultural Crop Report, 1965 (Napa, California). The export sales distribution was estimated and weighted by the corresponding income elasticity as follows:

Crop	Fraction of sales	Income elasticity
Grapes	.50	1.50
Field and truck	.25	.12
Other fruit	.25	.25

Given the per capita income increase, the weighted increase in consumption per capita relative to 1965 was estimated as 1.20 (California income growth was used). This figure was then scaled up by the population growth factor to obtain a scale factor of 1.70 for the Bay area and 1.79 for the rest of the world.

For livestock agriculture, Heady, op. cit., presents an income elasticity for meat animals of .48. This implies a per capita consumption factor of 1.12 relative to 1965 (for California). This was then scaled by the population growth factors to obtain scale factors of 1.59 for the Bay area and 1.67 for the rest of the world (identified as California outside the Bay area for this sector).

For wineries, an income elasticity of 1.5 was assumed based on earlier discussion. This implied a per capita consumption factor of 1.37 for the Bay area. This was multiplied by 1.42 (population) to obtain an overall scale factor of 1.95. For the rest of the world, these factors yielded 1.77 as the overall effect (1.46 times 1.21).

(Continued on next page.)

TABLE 58--continued.

For manufactures (large, medium, and small), per capita growth rate for manufactures estimated as 2.86 from U. S. Office of Business Economics, op. cit., and United States population data from U. S. Bureau of the Census, Statistical Abstract of the United States: 1965 (86th edition), 1965, p. 5. Projected to 1980, this implied a growth per capita of 1.53 for the Bay area shipments. This was multiplied by .954 (income differential) and 1.42 (population effect) to obtain 2.07 as the final scale factor. For the rest of the world shipments, 1.53 was multiplied by 1.21 (population effect) to obtain 1.85.

For wholesale and retail trade, scaled by population growth and per capita income growth factors for areas involved.

Col. 4: For wineries, tourist growth rate estimated as 4.46 percent from data in Table 24, supra, p. 52. This led to a 1980 projection of twice the 1965 level.

For wholesale and retail trade and services, the Lake Berryessa component of these sales was set at 2.5 the 1965 level on the basis of the previous discussion of the Lake Berryessa development. Other sales to tourists were scaled at 2.3 the 1965 level, a level between the winery and Lake Berryessa factors.

Col. 5: For wineries, wholesale and retail trade, services, construction, and local government, 1965 value scaled by 2.7, a value lying between federal and state scale factors developed for tax levels in 1980, Table 57, supra, p. 173. The federal factor was (1.69) (1.36) = 2.3, and the state factor was (2.38) (1.36) = 3.2. It was assumed that (1) the tax rate structure would not change and (2) government expenditures in Napa would increase in proportion to tax collection increases.

were then applied. For wineries, the income elasticity of 1.5 was again utilized. Per capita increases in income and population growth for the Bay area and for the United States (treated as corresponding to the "rest of the world") were incorporated. The resultant increase in final demand is roughly twice the 1965 level.[1/] In projecting exports of manufactures, the growth rate in the United States consumption of manufactures per capita was the basic datum. The Bay area had a slower projected income growth rate than did the United States as a whole; this was accounted for in developing the Bay area forecast. Introducing respective population increases completed the projection process. A similar procedure was carried out for services. Wholesale and retail trade were scaled by population growth and income growth projections for the areas involved. The relatively small amount of construction sales made to purchasers outside the County was scaled by the same factor used in the household construction projection.

Tourist Spending

Growth in winery tourism was estimated as 4.46 percent per year on the basis of Table 24. This led to a 1980 projection of twice the 1965 level. For wholesale and retail trade, and for services, the Lake Berryessa component was set at 2.5 the 1965 level on the basis of the detailed discussion of the Berryessa development. Other sales to tourists were set at 2.3 the 1965 level, a figure between the winery and Berryessa scale factors.

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1/ The occurrence or absence of grape land preservation (National Vineyard or continuation of the Agricultural Preserve) would have some impact on production of grapes and output of wineries. However, land-use projections for 1980 indicate the forecast figure used here is within capacity levels of available grape land, even with a return to earlier zoning. Again, some reduction of wine quantity might be partially offset by price increases. Because 1980 preservation effects thus appear to be marginal, no further refinement was attempted in the broad brush, general projection utilized here. For longer term forecasting, however, preservation policy should have an impact too important to be ignored.

Government Expenditures

The 1965 government expenditure levels were scaled by 2.7, a value between projected federal and state tax scale factors. The latter were developed using per capita tax projections based on the consumer expenditures survey of this study and population projections. It was assumed that the tax rate structure would not change and that government expenditures would increase in proportion to tax increases.

Outputs

The component sales to final demand sectors are aggregated in Table 59. This aggregated set of figures was then used as forecast final demand to obtain forecast outputs, also presented in Table 59. Outputs for 1980 relative to 1965 are presented by sector. Greatest increases occur for construction, local government, services, and medium manufactures, with each more than doubling its output. Livestock agriculture has the lowest growth, with an increase of about 60 percent. All other sectors grow by 80-100 percent.

Alternative results would emerge using different assumptions in developing final demand forecasts. The results in Table 59 are presented as illustrative of the forecasting process and of possible application of the input-output tables, given the assumptions made here. Those assumptions, of course, seemed the most reasonable to be made, given the available evidence. (In fact, "provisional estimates" might be more accurate a term than "assumptions.") As a consequence, the output forecasts should be useful in long-term planning for the Napa County economy.

TABLE 59

Final Demand and Output Forecasts, Napa County, 1980

Sector	Final demand		Output		1980/1965
	1965	1980	1965	1980	
	1,000 dollars				
Crop agriculture	2,889	4,991	8,130	14,676	1.81
Livestock agriculture	14,170	22,572	14,220	22,666	1.59
Wineries	14,221	26,203	14,474	26,671	1.84
Manufactures--large	67,787	130,290	71,247	138,299	1.94
medium	5,500	11,010	7,247	14,641	2.02
small	5,174	9,602	9,765	18,379	1.88
Wholesale and retail trade	104,140	191,905	137,289	256,023	1.86
Services	29,969	63,650	32,169	67,936	2.11
Construction	14,930	38,273	21,305	52,794	2.48
Finance, insurance, real estate and rentals	27,192	49,258	40,019	73,755	1.84
Transportation, communication, and utilities	6,134	10,182	19,558	36,162	1.85
Local government	13,338	32,367	19,173	43,288	2.26

Sources: Table 58 data were aggregated to obtain final demand forecasts, supra, p. 175. Output forecasts were then obtained using the 12-sector matrix of Table 48, supra, p. 144.